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TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high—and the Editorial Board will feel obliged if your articles are brief.

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Editorial

Plant Protection: In dealing with the food problem facing the country, emphasis has till recently been laid both by administrators and scientists on the aspects relating to increasing production by various means such as irrigation, application of fertilizers and introduction of improved varieties of crops. These are undoubtedly important aspects but it should not be forgotten that the losses in crop production caused by pests and diseases in the field and in storage are enormous and if timely and adequate steps are taken to reduce such losses the quantity of our available food supply would be increased considerably.

It is the realisation of this important aspect of the food problem in recent years that has led both the Central and Provincial Governments to pay increasing attention to the organisation of research and the strengthening of field staff, with a view to helping the cultivator in combating pests and diseases that affect his crops. A special Plant protection service to tackle problems on an All-India basis is functioning in New Delhi. In Madras, the organisation for plant protection has been strengthened recently, by the appointment of four plant protection officers for the Province and two plant protection assistants for each district. Provision has also been made, we understand, to supply the necessary fungicides, insecticides and spraying machinery to each district. We hope, that the cultivators would take full advantage of the plant protection organisation and seek its aid in combating the pests and diseases affecting their crops.

While the setting up of a plant protection service by Government is an important step, much yet remains to be done before the full benefit of the organisation is to be realised by the cultivators. Fungicides and insecticides are in short supply and spraying machinery suited to Indian conditions are not available. India is entirely dependent on foreign countries for the supply of spraying machinery and the cost of these appliances is often beyond the means of the

ordinary cultivator. Any measures taken to combat pests and diseases to be successful should cover the entire affected area and lack of means to cover large areas in a given time is one of the chief reasons why the methods sometimes fail to achieve the desired results.

It is time, therefore, that our industrialists turn their attention towards manufacture of spraying machinery and chemicals needed for Plant protection and we can assure them that a profitable future awaits those who embark on this enterprise.

The use of Fertilizers: We are glad that the Government of India are appointing an expert committee under the chairmanship of Dr. J. N. Mukerjee to go into the question of the use of fertilizers and organic manures, and submit their recommendation after an exhaustive enquiry and examination of relevant data that are available from the various Agricultural Research Stations in the country. While we do not wish to anticipate the findings of the expert committee we have no doubt in our own mind that considering the inadequacy of organic matter in most of our soils and the difficulty of replenishing it from outside due to limitations in our water supply, judicious use of fertilizers is one sure means of increasing our agricultural production. We are aware that virulent attacks on the practice of using fertilizers have been made in recent years and an attempt has been made to create a controversy where, in fact, there is none. No one claiming to be a scientific agriculturist minimises the importance of the value of organic manures. The careful conservation of organic refuse and their utilisation to the fullest possible extent are essential for crop production. But it should not be forgotten that the introduction of fertilizers about a century ago has led to enormous increase in food production throughout the world and if countries like America, Japan and Russia have trebled their acre yields of crops within the past few decades, the fact is attributable to a very great extent to the use of fertilizers.

We have ample evidence in this country that many crops benefit by the application of fertilizers and though here and there instances may be found of the adverse effects of *unbalanced* manuring it will be found on the study of evidence that proper balanced manuring has resulted in increased output.

The report of the expert committee will be eagerly awaited by all those interested in the agricultural progress of this country and we have no doubt that they will complete their task with expedition.

More Sugar Per Acre

By

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I. **Introduction.** In any balanced system of food production, the production of sugar must form one of the important items. The demand and consumption of sugar is increasing and we are feeling more and more the deficiency of sugar in this Province, whose quota has to be supplemented from the other Provinces. Sugarcane cultivation is mainly confined to the tropical belt but in this country, its cultivation as well as the sugar industry is developed to a greater extent in the sub-tropical North India than in the tropical Southern Peninsula. Considering the favourable soil, climatic and varietal conditions for sugarcane in the Madras Province, the white sugar industry must be said to be still very backward when compared to the other Provinces as shown below :

TABLE I.

Number of sugar factories working in 1944—'45, actual quantity of cane crushed, sugar produced and recovery per cent obtained.

Province.	No. of mills working.	Cane crushed (Tons)	Sugar (Tons)	Cane consumed in factories as % of total cane produced.	Sugarcane Recovery per cent.
United Provinces	67	5,185,000	528,900	21 6	10·20
Bihar	29	1,588,600	169,900	30·9	10·69
Madras	11	510,400	46,500	6·0	9 11
Bombay	10	694,200	74,900	14 0	10·79

It is thus clear that to meet the demand and to make up the deficit of sugar in our Province an all-out drive for greater sugar production is essential and it is the object in this small note to make some suggestions for production of more sugar without increasing the area under sugarcane.

II. **Varietal.** One of the chief means by which improvement in sugar production is achieved is by the selection of better varieties than the ones in use. No doubt, our objective is to select high yielders coupled with high sugar content. Unfortunately few varieties combine those two qualities. The cultivator prefers to grow high-yielding varieties of cane, while the sugar manufacturer prefers high sugar varieties. Since our objective is "More sugar per acre" so as to increase the output per unit

area of land, the selection of varieties from the factory point of view should be on the basis of "more sugar per acre". Work done at Anakapalle has shown that varieties differ considerably as regards their sugar yield per acre.

TABLE II.

Approximate amount of available sugar—Tons per acre.

Variety.	November.		December.		January.		February.		March.		April.		Yield of cane per acre
	Sugar	C. C. S.	Sugar	C. C. S.	Sugar	C. C. S.	Sugar	C. C. S.	Sugar	C. C. S.	Sugar	C. C. S.	
Co 419	4·6	8·33	5·5	9·97	5.9	10·63	6·7	12·26	6·8	12·42	6·0	10·95	55
Co 421	3·9	9·22	4·6	10·93	5·2	12·27	4·9	11·69	4·4	10·35	4·3	10·26	42
Co 443	3·7	8·82	4·3	10·18	5·0	11·93	5 4	12·76	5·2	12·35	4·9	11·60	42
Co 508	4·0	10·73	4·8	12·96	4·7	12·68	5·1	13.70	4·8	12·95	4·9	13·35	37
Co 523	3·9	9·37	4·2	10·03	4·6	11·02	4·8	11·38	4·8	11·30	4·7	11·20	42
Co 527	3·6	8·46	4·7	10·96	5·2	12·07	5·4	12·45	5·2	12·12	5·2	12·14	43
POJ 2878	3·3	9·72	4·5	13·12	4·3	12·59	4·8	14·05	3·9	11·34	3·9	11·36	34

The data would show that varieties like POJ 2878, in spite of high CCS% cannot compete with Co 419 with respect to total sugar out-turn because of the lower yields. Certain varieties like Co 527 keep for a longer time than other varieties and can be crushed from December profitably taking the minimum C. C. S. requirement of sugar factories to be 10%.

In Table I, it was noted that the present recovery of sugar on cane in Madras is comparatively less than in Bombay and other Provinces. This may be partly due to immature canes being crushed by some of our factories. At least in the Madras Province, all the cultivators invariably take to Co 419 because of its high tonnage and its resistence to many unfavourable conditions. But, unfortunately, the cane is late-maturing and hence the recovery is poor in the initial stages. For the sugar factories to obtain higher recoveries and produce more sugar in unit time as also prolong their crushing period, they should take up the cultivation of varieties that give uniform recoveries and sucrose percentages for at least five months. Work at Anakapalle has shown that by crushing "Early", "Mid-season", and 'late' canes, the factories can prolong their crushing period and also get uniform recoveries for a longer time. Varieties Co 527 for early season, Co 449 for mid-season and Co 419 for late season have been recommended by this Station after much research on the basis of their ripening qualities as shown below:—

TABLE III.

Juice quality of early, mid-season and late canes at Anakapalle.

Serial No.	Variety.	Nov. Suc %	Nov. Purity %	Dec. Suc%	Dec. Purity %	Jan. Suc %	Jan. Purity %	Feb. Suc %	Feb. Purity %	Mar Suc %	Mar Purity %	April Suc %	April Purity %	May. Suc %	May. Purity %	Remarks.
1.	Co 527	13·36	82·77	17·39	86·50	17·61	87·34	18·06	88·80	18·34	91·73	17·29	83·66	17·37	86·32	Early
2.	Co 449	14·16	85·33	16·86	83·47	17·61	91·03	18·37	90·14	18·25	91·52	15·11	86·06	...	...	Mid-season
3.	Co 419	7·82	66·04	12·53	76·79	14·22	82·39	16·17	86·74	18·10	90·99	19·70	88·49	18·42	90·65	Late.

It would thus be clear that by a judicious crushing of early, mid-season and late canes, the factory economy can be increased and the out-turn of sugar considerably enhanced. But, unfortunately, the early and mid-season canes cannot compete with Co 419 as regards yield and to encourage the above varieties, a premium should be offered to compensate for the low yield. Ratoons mature earlier and hence the factories start crushing ratoons first. But this practice cannot altogether dispense with the need for 'early varieties' which would be suitable for crushing from Nov-Dec. onwards. Further, continuous ratooning is not conducive to increased tonnage of cane. Therefore, high-yielding and early maturing varieties must be encouraged in the factory areas by the offer of bonuses to off-set their lower yields.

III. **Manurial.** By careful and controlled manuring, increased yields of sugar can be realised. Of the plant-food elements, sugarcane responds most to nitrogen. Large applications of nitrogen especially in the form of Ammonium Sulphate and ground-nut cake in proportions of 2:1 or 1:1 have been tried in various Research Stations. In all these trials, one common conclusion is that while increasing doses of N may increase tonnage output of cane per acre, it delays maturity and may depress sucrose content also. The optimum dose, therefore, is one that gives increased yield per acre without delaying maturity or depressing sucrose content. In other words, maximum sugar per acre consistent with increased cost of manuring must be the criterion. This is illustrated by the data from the experiment on graded doses of N conducted at the Sugarcane Research Station, Gudiyatham.

(1945—'46.)

Dose of Nitrogen lb. per acre.	Yield in tons per acre.		Juice analysis at Harvest.	
	Cane	Sugar	Sucrose %	Purity.
0	24·77	4·71	19·00	90·95
50	30·75	5·89	19·15	91·09
100	45·09	8 66	19·20	90·48
150	43·86	8·03	18·30	88·76
200	50·30	8·76	17·42	85·72
250	49·77	8·67	17·42	85·31

It is seen from the data that increased yields in tonnage of cane per acre beyond 100 lb. N, have not resulted in a proportionate increase in tonnage of sugar per acre. Experiments on the application of Nitrogen to sugarcane were reported from the Agricultural Research Stations, Anakapalle, Samalkotta, Gudiyatham and Palur. A perusal of the data shows that the northern and southern districts differ in their N requirements for sugarcane. From the available data it may be recommended that:—

(i) There is no significant increase in tonnage of cane between the dosage 100 lb. N to 200 lb. N in the Anakapalle and Samalkotta Farms.

(ii) At Gudiyatham, there is evidence for increase in tonnage of cane upto 200 lb. to 250 lb. N.

(iii) At Palur, there is increase in tonnage of cane even upto 250 lb. N and there may be response even to larger doses.

(iv) The delay in maturity and depression in sucrose %, starts at about 150 lb. N level at Anakapalle and Samalkotta, while it is about 150 lb. N at Gudiyatham and at about 200 lb. to 250 lb. N at Palur.

The available data are not sufficient to calculate available sugar per acre and hence critical levels for sucrose recovery cannot be fixed at present. In general it may be stated that a lower dose of N is desirable in a richer class of soils, and higher doses in poorer classes of soils in respect of tonnage, increase of cane, sucrose recovery and normal maturity.

IV. **Technical efficiency of factories.** No amount of improvement in yield and quality of cane can help in stepping up sugar production, if the efficiency of the factory is poor. Compared to other sugar-producing countries, the technical efficiency of Indian factories is low:

TABLE

Efficiency of factories and recoveries in India as compared to other countries.

	India	Hawaii	Java	Formosa
Cane—Sucrose per cent	12·18	11·95	13·22	13·30
Cane—Fibre per cent	16·18	13·44	12·60	12·60
Mixed Juice	80·45	82·38	84·30	85·30
Extraction	91·22	96·32	94·60	95·20
Over-all recovery	79·58	87·35	85·83	85·10
Over-all recovery reduced technical efficiency	85·04	89·44	86·36	84·92
Yield per cent as Sugar	9·74	10·74	11·16	11·48
Yield per cent as Sugar (96 Pol)	10·10	10·90	...	11·80

(From N. L. Dutt's Report.)

The lower recovery in India as compared to Hawaii and Formosa cannot be attributed to poor juice quality as can be seen from the figures given below (from Dutt N. L. 1946.)

TABLE

Juice analysis of varieties in India, Hawaii, Queensland and Natal

Particulars.	**India.**				**Hawaii.**			
	Co 312	Co 421	Co 419	Co 313	K. 107	D. 1135	31–1389	H. 109
Brix	19·8	20·4	21·8	20 6	21·3	21·4	18·5	17·9
Pol.	18·3	17·9	20·3	18·2	18·3	18·2	15·5	15·4
Purity	92·5	87·9	93·1	88·4	85·9	84·9	83·9	85·1

Particulars.	**Queensland.**				**Natal.**		
	E. K 28	Badilla	POJ.2878	Co 281	Co 290	Co 301	UBA
Brix	22·2	22·6	21·9	20 0	18·7	21·1	18·8
Pol	20·3	20·8	19·9	18·2	16·4	19·3	16·4
Purity	91·2	91·9	90·6	90·9	88·0	91·5	86·9

The juice quality is as high as in the other sugar-producing countries and the defect must be attributed to the lower efficiency of the factory machinery. It is necessary that our factories are equipped with up-to-date machinery to improve the extraction as well as recovery. Dutt pointed out that average recovery in this country improved from 8.70 in 1934 to 9.72 in 1940 and of this, 82.35% is due to improvement in varieties and 17.65% is due to improvement in factory efficiency. Therefore, under the existing conditions, large improvements in recovery are possible if a proper varietal schedule is adopted.

V. **Summary.** Yield of cane and sugar per acre and the development of sugar industry as well as its present efficiency, are all capable of further improvement in this Province. Among the varieties now released from Anakapalle Sugarcane Research Station, Co 527 for early Co 449 for mid and Co 419 for late seasons are recommended. In regard to manuring it is pointed out that nitrogen is the most important. Beyond a particular dose, there is delay in maturity and depression in sucrose per cent. Therefore, the nitrogen level is to be judiciously fixed. The northern districts in general, require a lower level of nitrogen than the southern districts. India in general, and this province in particular, is poor in factory efficiency with poor sugar recovery. Due to current international and post-war restrictions, it would be difficult to renew the machinery. Therefore, the factories can resort to proper varietal schedules in order to improve their recovery per cent. By the above methods it is suggested that total output of sugar per acre can be increased.

VI. **Acknowledgment.** Our thanks are due to Sri R. Vasudevarao Naidu, Sugarcane Specialist, Anakapalle, for the keen interest evinced in the preparation of this note.

VII. **Literature.** Dutt N. L. (1946) Report on Survey of Sugarcane Research in India. Gandhi M. P. (1946) Indian Sugar Industry Annual. Madras Agricultural Station Reports 1935—'36 to 1947—'48 Thirumal Rao W. and Sriraman K. (1943) Commercial cane sugar value and its importance. M. A. J. XXXI. p. 317.

Joss Sticks from Bagasse:— Yoshi Twata, Tsuneo Jatsuno and Toe Shiang Wu. (pp. 100—103, 1947)—When bagasse is soaked for about two weeks in lime water it undergoes fermentation and chemical change and becomes moldable by machine to form sticks or coils, which when dried burn smoothly and produce an abundant smoke that has a repellant effect on mosquitoes. If the molded material is mixed with 10% of powdered dry leaves of essential oil-bearing plants (eucalyptus, citronella) the smoke is strongly repellant and largely fatal to mosquitoes. *(Sugar, Vol. 43, No. 7, July 1948, p. 49.)*

A Note on Arrowing in Sugarcane Clumps

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Age of crop, seasonal phenomena, effect of environment, cultural and manurial treatments and influence of parent stock are some of the more important factors that affect flowering in sugarcane. Age of shoot and arrowing are positively correlated (6). Ratooning, is known to induce more arrowing (5). Increased doses of nitrogenous manures have a tendency to improve vegetative growth and retard flowering (4). Among environmental factors that have a bearing on arrowing, water-logging in the field is one (3) and the photo-period or the amount of light received by the cane clumps during their growth periods is another (1). For instance, in a trial laid out at the Sugarcane Breeding Station, Coimbatore, a majority of cane clumps receiving extra light were reported to have failed to flower. In an experiment with Co 421 at the Sugarcane Research Station, Anakapalle, during three successive years (1940–'41 to 1942–'43) arrowing in individual cane clumps was studied with reference to number of canes in each clump and the results of this study are presented in this paper.

2. **Material and Methods.** One thousand plants (primary shoots) were selected at random from a crop of Co 421, planted in rows 2'8" apart in March with single-budded setts at regular distances (10" between sett and sett along the row). It was thus possible to know that a particular shoot arose from a particular bud and demarcate the individual cane clumps clearly. Tillers arising from these plants till the end of August were marked at four-day intervals by labelling them as 1, 2, 3 and so on. Shoots coming up later on were removed as they were not likely to grow up to give useful canes by next February, the usual harvest time of Co 421 at this Station. The objective was to find out the correlation between age of shoot and arrowing and juice quality in Co 421 and the influence of shoot density on arrowing in cane clumps. In the second year of the experiment, there was practically no arrowing in this and many other varieties at Anakapalle due to uncongenial seasonal conditions. Hence the results of only 1940–'41 and 1942–'43 are considered in this paper.

Kashibuchi reported from Tainon, in Formosa "that differentiation in flower bud occurs by the end of September" (2). Co 421 usually completes flowering by the end of November at Anakapalle. Hence environmental and other factors will influence arrowing only if they are present before this period. Therefore to study the effect of the number of canes in a clump on arrowing (of canes) in the same, shoots living till the end of November in each of these thousand clumps were taken into account.

3. **Results and Conclusion.** Among the cane clumps studied (clumps were grouped according to the number of canes 1, 2, 3, etc. in each clump as shown in the table below) the percentage of arrowed cane clumps increased more or less progressively as the number of canes in each clump (shoot density) in the different groups increased. Results are presented in the following table :

	1940-'41			1942-'43		
No. of canes in each clump by the end of November.	No. of clumps having the different number of canes mentioned in column (1).	No. of clumps in column (2) with arrowed canes.	No. of arrowed clumps as a percentage of the total number of clumps with the same shoot density (col. 3 as % of col. 2.)	No. of clumps having the different number of canes mentioned in column (1).	No. of clumps in column (5) with arrowed canes.	No. of arrowed clumps as a percentage of the total number of clumps with the same shoot density.
1	2	3	4	5	6	7
1	69	6	8·70	186	14	7·53
2	133	17	12·77	262	63	24 04
3	206	40	19.42	267	80	29·96
4	224	62	27·68	128	50	39·06
5	172	71	41·29	30	14	46·67
6	88	37	42·05	6	4	66·67
7	28	9	32·14	...	...	...
8	9	6	66·67	...	...	...
9	6	3	50·00	...	...	...
10	2	...	...	...	...	...
11	...	...	...	...	...	...
12	1	...	...	...	...	...

N. B. — There was a high and significant positive correlation between shoot density in cane clumps and arrowing. The values of correlation coefficients for 1940-'41 and 1942-'43 were $+ 0·8979 \pm 0·0646$ and $+ 0·9822 \pm 0·0144$ respectively.

The results indicate that the factors that cause arrowing had a greater influence on the clumps with a higher shoot density than those with a fewer number of canes in each. Increase in the number of canes in a clump must have resulted in decreased nutrition to the individual shoots and as in the case of restricted manuring, induced flowering. Preliminary studies to test the applicability of this finding (that arrowing in cane clumps is positively correlated with their shoot density) in the case of two other varieties, Co 419 and Co 467, during 1946-'47 indicated substantial agreement with these results.

4. **Acknowledgment.** This paper was prepared while I was working at the Sugarcane Research Station, Anakapalle. My heart-felt thanks are due to the Superintendent of that Station who kindly gave me all facilities for work. My thanks are also due to the Indian Council of Agricultural Research who partly financed research work at this station during that period.

5. References.

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Optimum Nitrogen Requirements of Sugarcane in the Anakapalle Tract

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I. **Introduction.** One of the main objects of sugarcane research at Anakapalle, is to draw up a manurial schedule for the tract in which the research station is situated. Earlier experiments on the problem on this station, indicated that nitrogenous manuring was a difinite necessity for sugarcane, while in the case of phosphatic and potassic manuring distinct advantages have not been secured. Attention was therefore concentrated on nitrogen, and to this end, an experiment with six levels of nitrogen with and with out a basal dressing of farmyard manure was conducted over a period of three years (1944–47) to study the influence of the different manurial doses on the yield, juice quality and economics of manuring, in respect of Co 419, the standard cane variety of the tract. The results of the experiment are presented in this paper.

II. **Material and Methods.** The experiment was laid out with six treatments, consisting of six levels of nitrogen (a) 0 lb. (b) 50 lb. (c) 100 lb. (d) 150 lb. and (f) 250 lb. of nitrogen per acre supplied in the form of groundnut cake, independently and in combination with a basal dressing of ten tons of farmyard manure per acre. The layout was in a split-plot design with four replications where farmyard manure and no farmyard manure constituted the two major treatments, while the six levels of nitrogen formed the minor treatments. The farmyard manure was applied fifteen days prior to planting and covered by working with ploughs. Analysis of this manure during 1945–46 and 1946–47 indicated that application at the rate of ten tons per acre was equivalent to 72·8 lb. and 86·5 lb. of nitrogen per acre in the two years respectively. The minor treatments were applied to the crop in two equal halves, one at the time of planting in March and the remainder at the time of trenching and earthing up in June. During the year 1944–'45 the experiment was laid out in wetlands but in the two subsequent years had to be accommodated on garden land. Germination, growth, arrowing, quality of juice and yields of cane and jaggery were the different items of study during the three years of experiment. The results obtained for each of three years separately are presented and discussed below.

III. **Results**: *(i) Germination.* In all the three years of the experiment the crop was planted by the middle of March with seed material

taken from a crop aged about seven months, as is usual on the station. The seed rate adopted was 15,000 three-budded sets per acre. Starting from the fifteenth day after planting, the extent of germination of the planted buds in the entire field was noted four times at weekly intervals. As such the influence of the major treatments and half the quantity of each of the different levels of nitrogen was reflected in the extent of germination in the respective treatments. The final germination percentages recorded five weeks after planting, are presented in Table I.

TABLE I.

Effect of nitrogen levels on the percentage of germination

Treatments			Years 1944—45	1945—46	1946—47	Average
Minor Treatments.						
0 lb. N	F. Y. M.		60	64	73	65·7
	No F. Y. M.		59	65	73	65·7
		Average	59·5	64·5	73·0	65·7
50 lb. N	F. Y. M.		62	64	74·0	66·7
	No F. Y. M.		63	65	74	67·3
		Average	62·5	64·5	74	67·0
100 lb. N	F. Y. M.		t1	67	76	68·0
	No F. Y. M.		64	70	76	70 0
		Average	62·5	68 5	76 0	69.0
150 lb. N	F. Y. M.		62	65	77	68 0
	No F. Y. M.		64	70	74	69·3
		Average	63·0	67 5	75·5	68·7
200 lb. N	F. M. M.		61	67	77	68·3
	No F. Y. M.		64	71	75	70·0
		Average	62·5	69·0	76·0	69·2
250 lb. N	F. Y. M.		64	70	73	69·0
	No F. Y. M.		63	69	75	69·0
		Average	63·5	69·5	74·0	69·0
S. E. of treatment Mean %			1·63	2·06	1·70	
C. D (P = 0·05) %			4·71	5·94	4·92	
Major Treatments.						
	F. Y. M.		6?	66	72	66·7
	No F. Y. M.		61	68	71	66·7
S. E. of treatment mean %			1·52	0·80	0·90	
C. D. (P= 0·05) %			6·84	3·60	5·23	

Treatmental differences in minor as well as major treatments were not significant by 'Z' test in any of the three years.

The differences in germination percentage between the various treatments (major and minor) were found to be statistically not significant. Thus the findings of Rege and Sunnabhadti (1944) that a minimum of 15 lb. of nitrogen (when applied as sulphate of ammonia) per acre was necessary to ensure optimum germination was not borne out here. There was no doubt a slight improvement in germination due to manuring, but it was not statistically significant. From the stand point of

total germination, application of 50 lb. of nitrogen as groundnut cake at planting i. e., (100 lb. nitrogen treatment) was as good as 125 lb. nitrogen treatment i. e., (250 lb. nitrogen treatment).

(ii) *Growth.* Ten canes were selected at random from each sub. plot (40 canes from each treatment) and their height (from the base to the last visible leaf joint) measured from July to January every year. The average maximum and initial heights recorded in each year are furnished in Table II.

TABLE II.

Average crop height in inches Co 419.

Nitrogen level lb. per acre.	Treatment.	1944—45 July '44	1944—45 Jan '45	1945—46 July '45	1945—46 Jan '46	1946—47. July '46	1946—47. Jan '47
Minor :—							
0	F. Y. M.	48	123	54	134	44	140
	No F. Y. M.	52	129	53	136	44	134
	Average	50·0	126·0	53·5	135·0	44·0	137·0
50	F. Y. M.	57	146	60	144	49	147
	No F. Y. M.	53	138	55	142	45	140
	Average	55	142·0	57·5	143·0	47·0	141·0
100	F. Y. M.	56	151	63	150	50	147
	No F. Y. M.	55	150	61	151	50	146
	Average	55·5	150·5	62·0	150·5	50·0	146·5
150	F. Y. M.	58	147	63	146	49	148
	No F. Y. M.	54	147	61	149	51	140
	Average	56·0	147·0	62 0	147·5	50·0	144·0
200	F. Y. M.	56	151	65	149	55	149
	No F. Y. M.	59	147	65	152	50	146
	Average	57·5	149·0	65·0	150·5	52·5	147·5
250	F. Y. M.	57	151	66	149	49	146
	No F. Y. M.	57	146	64	147	44	142
	Average	57·0	148·5	65	148·0	46·5	144·0
S. E. of treatment Mean %		1·39	2·33	1 73	1·94	2·60	2 57
Critical Difference (P = 0 ·05) %		4·01	6·73	5·00	5·60	7·51	7·42
Major :—							
	F. Y. M. Series	55	145	74	145	48	155
	No F. Y. M. Series	55	143	72	146	47	141
	S. E. of treatment Mean %	0·854	1·40	1·08	0·74	1·38	0·33
	Critical Difference (P = 0·05) %	3·840	6·30	4·86	3·33	6·21	1·48

Statistical analysis of these data disclosed that differences due to minor treatments alone were significant during the first two years both with regard to initial and maximum heights. In the final year, however, only the differences between the major treatments were significant; and that too, with regard to maximum heights alone. There was an indication that farmyard manure had a beneficial effect on crop height, though it was not very marked in 1946–'47, when conditions were abnormal in that the rainfall from planting till the end of the grand period of vegetative growth was very low. It was only 22·09 inches, as against nearly twice this quantity received in the previous two years. The crop was kept alive by lift irrigation and farmyard manure plots probably retained more moisture and consequently promoted better growth than

in the "no farmyard manure" plots. Doses of nitrogen beyond 100 lb. per acre did not improve the average crop height. Fifty pounds of nitrogen was distinctly inferior to 100 lb. nitrogen treatment. There was no interaction between the major and minor treatments in any year

Thus the général indication of these results was that manuring gave initial advantage in growth, prior to July or setting in of the South-West Monsoon. Afterwards, weather conditions rather than manuring must have influenced the growth of plants as was evidenced by the nonsignificance of the difference between the rates of growth recorded by major and minor treatments in two out of three seasons. These results agree with those recorded on this station and the Sugarcane Research Station, Gudiyatham, in the same year reported by Vasudeva Rao (1940). Carnelison A. H. and Cooper H. F. (1940) also reported, though in another context, that growth rate did not vary exclusively with variation in nitrogen treatments alone. Under their conditions temperature was the dominant factor determining the growth whatever be the amount of nitrogen supplied.

(iii) *Arrowing.* Co 419 does not flower freely at this station even in wet lands. On garden lands it does not flower at all. In this experiment there was arrowing in only one season (1944–1945) and the results are included in Table III below. Arrowing was suppressed in the higher nitrogen treatments (100 lb. nitrogen and over) and even in the lower levels the extent of arrowing decreased with an increase in the nitrogen level.

TABLE III.

Extent of arrowing

Treatments	Percentage of arrowed to total number of stalks in the different treatments.
Major.	
No farmyard manure series	6·13
Farmyard manure series	0·17
Minor.	
0 Lb. of Nitrogen	5·75
50 lb. of Nitrogen	0·56

There was no arrowing at all in the higher nitrogen levels

(iv) *Incidence of stem-borer.* To study the incidence of borer attack in relation to the different levels of nitrogenous manuring, 50 canes from each sub-plot and 200 canes in all for each treatment were examined. The percentage of canes and internodes affected by borers were determined in all the three years and the results are given in Table IV. From the data it is seen that the differences between the several treatments (major and minor) were statistically nonsignificant. Maximum borer attack was noted in the highest nitrogen treatment in two out of three years and this observation is in agreement with that reported by Dutt (1946).

TABLE IV.

Percentage of canes affected by borer.

S. No.	Treatment.	1944—45 Canes.	1944—45 Internodes	1945—46 Canes.	1945—46 Internodes.	1946—47 Canes.	1946—47 Internodes.	Average of 3 years. Canes	Average of 3 years. Internodes.
Minor									
1.	0 lb. N.	42	5·43	86	8·10	36	1·98	56	5·17
2.	50 lb. N.	44	4·16	86	8·80	34	1·68	55	4·87
3.	100 lb. N.	46	4·32	80	7·82	36	2·11	54	4·75
4.	150 lb. N.	39	4·74	80	7·72	36	1·94	52	4·80
5.	200 lb. N	36	5·59	72	5·03	40	2·03	49	4·22
6.	250 lb. N.	40	4·83	91	9·61	44	2·77	58	5·74
	S. E. of treatment Mean (%)		11·74	...	...	...	16·08	...	...
	C. D. (P = 0·05) %		33·90	...	...	...	46·30	...	...
Major									
	F. Y. M Series.	...	4·60	...	...	...	2·14	...	...
	No F. Y. M. Series	...	5·11	...	...	...	1·96	...	...
	S. E. of treatment Mean %.	...	14·00	...	...	...	...	...	2·30
	C. D. (P = 0·05) %	...	63·03	...	...	...	...	...	10·37

N.B.—Treatment differences were not significant by 'Z' test.

(v) *Juice quality.* Samples of cane juice from each of the treatments were analysed once a month from January till harvest each year. The results of chemical analysis recorded in March (the usual month of harvest of Co 419) for each of the three years separately are presented in Table V.

On an examination of the data presented in Table V, it is seen that the effect of the different treatments (major and minor) on juice quality was not consistent. In a majority of cases "no farmyard manure" series registered more brix, sucrose, purity and glucose values than the "farmyard manure" treatment. In the first year, when there was no lodging of the crop, the average values of sucrose for the different minor treatments progressively decreased with an increase in nitrogen level. In the next two years, the trend of the results was inconsistent, for the reason that there was extensive lodging of the crop and it affected the quality of the juice to varying degrees. However, in all the three seasons, 200 lb. and 250 lb. of nitrogen tended to record lower sucrose and purity values but higher glucose contents. The results are in general conformity with those recorded at the Agricultural Research Station, Palur (1941) of this Province and in Bombay as reported by Rege and Sunnabhadti (1941). That increased nitrogen fertilisation resulted in increased glucose contents in cane juice was also reported by Borden (1945) from Hawaii.

TABLE IV.

Results of chemical analysis of Juice, Co 419.

Nitrogen level lb.	Treatment.	Corrected Brix. 44—45	45—46	46—47	Av.	Sucrose % 44—45	45—46	46—47	Av.	Glucose % 44—45	45—46	46—47	Av.	Purity % 44—45	45—46	46—47	Av.
Minor.																	
0 lb.	F. Y. M.	21·01	18·54	19 34	19·63	18 98	15·95	16 93	17 29	0·57	0·93	1·13	0·88	90 36	86 04	87·54	87·98
	No F. Y. M.	21·71	19·58	18·36	19·88	19·40	17·46	15·66	17·51	0·47	0·67	1·36	0·83	89 35	89 17	85·29	87 94
	Average	21·36	19.06	18·85	19·76	19·19	16·71	16·30	17·40	0·52	0·80	1·25	0·86	89·86	87 61	86·42	87·96
50	F. Y. M.	20·11	18·14	17·66	18·63	17·61	15 81	14·97	16·13	0 74	0·94	1·41	1 03	87·56	87·66	84·78	86·67
	No F. Y. M.	20·41	19·58	18·88	19·62	18·06	17·17	16·55	17 26	0·69	0 89	1·08	0·89	88·49	87 68	87·64	87·94
	Average	20·26	18·86	18·27	19·13	17·84	16·49	15·76	16·70	0·72	0 92	1 25	0 96	88·03	87·67	86·21	87·30
100	F. Y. M.	20·41	19·46	18·26	19.38	18·69	16·80	15·81	17 10	0·67	0·84	1·36	0·96	91 58	86·34	86 60	88·17
	No F. Y. M.	19·11	1·928	18·26	19·22	16·96	17·25	15 28	16·50	0·93	0·69	1·50	1·04	88 78	89 45	83·47	87 23
	Average	19·76	19·37	18·26	19·13	17·83	17·03	15·55	16·80	0·80	0·77	1·43	1·00	90·18	87·90	85·04	87·71
150	F. Y. M.	19·81	19·78	17·36	18·98	17·58	17 65	14·68	16·64	0·84	0·75	1·22	0·94	88·74	89·21	84·98	87·64
	No F. Y. M.	20·11	19·38	18·66	19·38	18·10	17·05	15·90	17 02	0·85	0·81	1·22	0·96	90·01	88·14	85·21	87·79
	Average	19·96	19·58	18·01	19·18	17 84	17·35	15·29	16·83	0·85	0·78	1·22	0·95	89 39	88·68	85·10	87·72
200	F. Y. M.	19·01	19·21	17·66	18·63	16 43	16 63	15 33	16·13	1·13	0·84	1·19	1·05	86·42	86·58	86·80	86 60
	No F. Y. M.	18·61	18.18	18·56	18·45	16·56	15·88	15·36	15·93	1·08	1·03	1·72	1·28	89 00	87 36	82 75	86·37
	Average	18 81	18·69	18·11	18·53	16·50	16·26	15·35	16·03	1 08	0·96	1·46	1·17	87·71	86·97	84·78	86·49
250	F. Y. M.	18 81	18·68	18·46	18·65	16·85	16·02	15·85	16·24	1·26	0 78	1·36	1·13	89 58	85·74	85·88	87·07
	No F. Y. M.	18·11	19·18	18·66	18·65	15·38	16·70	15 66	15·91	1·31	0 87	1·54	1·24	84·92	87 08	83·92	85·31
	Average	18·46	18·93	18·56	18·65	16·12	16·36	15·76	16·08	1·29	0·83	1·45	1·20	87 25	86·41	84·90	86·19
Major.	F. Y. M.	19·86	18·12	18 98	18·98	17·69	16·48	15·60	16·59	0·87	0·85	1·28	1·00	89·04	86·93	86·10	87·36
	No F. Y. M.	19·67	18·56	19·20	19·14	17·41	16·92	15·74	16·69	0·88	0 84	1·40	1·04	88·43	88·15	84·71	87·10

N. B.— (i) Percentages of each constituent on Juice weight are furnished.

(ii) Age of crop at the time of analysis was 354, 360, and 365 days in 1944—45, 45—46, and 46—47 respectively.

(vi) *Yield of cane.* The average yields of cane from the different treatments recorded in the three seasons are furnished in Table VI.

TABLE VI.

Yield of cane in tons per acre.

Treatments.		1944—45	1945—46	1946—47	Average for 3 years.
Minor.					
0 lb. N	F. Y. M.	35·16	44·62	44·36	
	No F. Y. M.	35·34	44·80	39·94	
	Average	35·25	44·71	42·15	40·70
50 lb. N	F. Y. M.	51·11	49·70	49·09	
	No F. Y. M.	44·75	46·71	40·96	
	Average	47·93	48·21	45·03	47·06
100 lb. N	F. Y. M	52·30	53·53	53·14	
	No F. Y. M.	52·48	51·96	49·09	
	Average	52·39	52·70	51·12	52·07
150 lb. N	F. Y. M.	55·60	45·95	47·78	
	No F. Y. M.	54·19	50·67	45·75	
	Average	54·90	48·31	46·77	49·99
200 lb. N	F. Y. M.	52·95	44·92	49·71	
	No F. Y. M.	55·13	48·90	47·21	
	Average	54·04	46·91	48·46	49·80
250 lb, N	F. Y. M.	57·88	47·35	50·46	
	No F. Y. M.	54·46	45·79	45·04	
	Average	56·17	46·57	47·75	50·16
S. E. of treatment mean-tons		1·264	1·57	2·337	
C. D. (P = 0·05)		3·649	4·53	6·749	
Major.	F. Y. M.	50·83	49·35	49·09	
	No F. Y. M.	49·35	48·14	45·00	
S. E. of treatment mean-tons		1·255	0·378	1·273	
C. D. (P = 0·05)		5·65	1·700	5·728	

The crop was harvested from 3rd to 23rd March, 17th April to 6th May and 17th March to 4th April in 1944—'45, 1945—'46 and 1946—'47 respectively. Although the farmyard manure series recorded higher yields, in general, there was no significant difference in yields due to major treatments. It was observed by Rege (1941) and Dutt (1946) that the influence of farmyard manure seemed to be more as a soil improver than as an effective supplier of plant food. But it was stressed that more elaborate and well-planned experiments were necessary to correctly assess the merit of this manure. This is borne out by the results of this experiment also. Among the minor treatments, treatment (f) 250 lb. N, gave the maximum yield in the first year (56·17 tons of cane per acre) but was statistically on a par with treatments (d) 150 lb. N and (e) 200 lb. N. Treatment (c) 100 lb. N recorded 52·39 tons of cane per acre and was fourth in order of merit. In the second year, treatment (c) 100 lb. N registered the highest yield of 52·70 tons of cane and was on a par with treatments (d) 150 lb. N and (b) 50 lb. N. In the final year the yield differences were not significant by 'Z' test. However, treatment (c) 100 lb. N, gave the maximum acre yield of 51·12 tons of cane. These results are at variance with those recorded at the Agricultural Research Station, Palur and Gudiyatham (1940) of this Province and by workers like Rege and Sunnabhadti (1944). But similiar results were recorded at the Agricultural Research Station, Samalkot (1940) where no significant

differences in yields were noticed between 100, 150 and 200 lb. nitrogen (per acre) treatments. Even at Shajahanpur (U. P.) in one experiment no significant differences between 100 and 200 lb. nitrogen treatments were noticed in two out of three years. This was reported by Rege (1941). In this connection, apart from the inherent fertility status of the soils, the influence of prevailing winds, usually common, in the East coast, should be taken into account. During 1944–'45 when there was practically no lodging, there was more or less a progressive increase in cane yields, with every increase in the nitrogen level. In 1945–'46 cyclonic winds prevailed in October followed by a flood and there was much damage due to lodging and breakage. During 1946–'47 also there was severe lodging and some breakage of canes. The crop under the treatments (c) to (f) which recorded practically similar maximum heights, seemed to have come in for a greater amount of damage than that in the lower nitrogen levels. Thus heavy lodging and breakage due to high winds in the higher nitrogen treatments seemed to be a contributory cause, apart from the inherent fertility status of soils, for the apparent inefficiency of treatments higher than 100 lb. nitrogen in increasing cane yields progressively. But one remarkable feature was the consistent performance of 100 lb N, which recorded almost similar yields in all the three seasons, irrespective of the type of land and even under adverse seasonal conditions.

(vii) *Yield of jaggery.* Trial jaggery (Gur) boilings from each treatment were made once at harvest time each year. The percentage of gur on cane weight from the farmyard manure and no farmyard manure series in the different years are presented in Table VII.

TABLE VII.

Yield of gur in tons per acre

Treatments		1944—45	1945—46	1946—47	Average for 3 seasons for both the major treatments.
Minor.					
0 lb. N	F. Y. M.	4·690	4·565	4·822	
	No F. Y. M.	4·789	4·404	4·661	
	Average	4·740	4 485	4·732	4·656
50 lb. N	F. Y. M.	5·975	4·697	4·801	
	No F. Y. M.	5·929	4·545	5·112	
	Average	5·952	4·621	4·957	5·177
100 lb. N	F. Y. M.	6 511	5·642	6·122	
	No F. Y. M.	6·597	5·804	5·528	
	Average	6·554	5·723	5·825	6·034
150 lb. N	F. Y. M	6·699	4·926	5 055	
	No F. Y. M.	6·828	5·837	4·689	
	Average	6·764	5·382	4·872	5·673
200 lb. N	F. Y. M.	6·433	4·366	5·220	
	No F. Y. M.	6·482	4·822	5·302	
	Average	6·461	4·594	5·261	5·439
250 lb. N	F. Y. M.	7·304	4·323	5·364	
	No F. Y. M.	6·219	4·620	5·081	
	Average	6·762	4 472	5·233	5·486
Major.					
	F. Y. M.	6·269	4·753	5·231	5·417
	No F. Y. M	6·142	5·005	5·062	5 403

The computed gur yields (based on gur recovery) from the different treatments are included in Table VIII.

TABLE VIII.

Per cent jaggery recovery on cane weight.

Treatments		1944—45	1945—46	1946—47	Average
Minor.					
0 lb. N	F. Y. M.	13 34	10·23	10·87	11·48
	No F. Y. M.	13·55	9·83	11 67	11·68
	Average	13 45	10·03	11·27	11·58
50 lb. N	F. Y. M.	11·69	9·45	9·78	10 31
	No F. Y. M.	13·25	9 73	12·48	11·82
	Average	12·47	9·59	11·13	11·06
100 lb. N	F. Y. M.	12 45	10·54	11·52	11·50
	No F Y. M.	12 57	11·17	11·26	11·67
	Average	12·51	10·86	11 39	11·59
150 lb. N	F Y. M.	12 05	10·72	10·58	11·12
	No F. Y. M.	12·60	11·52	10·25	11·46
	Average	12·33	11·12	10·42	11·29
200 lb. N	F. Y. M.	12·15	9·72	10·50	10·79
	No F. Y. M.	11·77	9·85	11·23	10 95
	Average	11·96	9 79	10 87	10·87
250 lb. N	F. Y. M.	12·62	9·13	10·63	10·79
	No F. Y M.	11 42	10·09	11·28	10 93
	Average	12 02	9·61	10·96	10·86
Major.					
	F. Y. M.	12·38	9·97	10·65	11·00
	No F. Y. M	12·53	10·37	11·36	11·42

The data presented in Tables VII and VIII indicate that the farmyard manure series generally recorded lower jaggery recoveries. In 1944 – '45 the jaggery recovery was found to decrease with an increase in the nitrogen level, as in the case of juice quality. In the second year (1945 – '46) there was no definite trend in the recoveries. In the final year (1946 – '47) treatments (a) 0 lb. N, (b) 50 lb. N and (c) 100 lb. N, gave recoveries very nearly equal to each other and the remaining three treatments gave lower jaggery out-turns. The influence of the seasonal conditions which governed the juice quality was also reflected in the jaggery recovery values each year. Maximum jaggery yields were recorded by the treatment (d) 150 lb. N followed by (f) 250 lb. N and (c) 100 lb. N, in the first season and in the subsequent years 100 lb. N treatment (c) gave the highest gur yields.

(viii) *Relationship between yield (cane and gur) and nitrogen utilisation.* According to Borden (1944) who worked out the relationship between yields of cane and sugar and consumption of nitrogen by crops, 2·9 lb. of nitrogen per ton of cane and 7·9 lb. of nitrogen per month were necessary for producing a 40 to 49 ton crop grown over a period of 17·4 months at Hawaii. For 50 to 59 ton crop aged 18·3 months 2·6 lb. N per ton and 7·9 lb. N per month were necessary. At Anakapalle, the utilisation of nitrogen was more efficient as is evidenced by figures given below. The results in respect of treatment (c) 100 lb. Nitrogen alone are furnished, in Table IX.

TABLE IX.

Nitrogen utilisation

Season	Age of crop Months	Yield (tons) per acre		Pounds of Nitrogen utilised		
				per ton of		per month
		Cane	Gur	cane	Gur	
1944—45	12·3	52·48	6·597	1·91	15·16	8 13
1945—46	13·2	51·96	5·804	1·92	17 23	7·58
1946—47	12·6	49 09	5·528	2·04	18·09	7·94

(ix) *Economics of manuring.* The cost of production per ton of cane in the different manurial treatments is presented in Table X. The lowest production costs were recorded by the treatment (c) 100 lb. N in both the farmyard manure and no farmyard manure treatments, except in one instance.

TABLE X.

Cost of production per ton of cane

Treatment Lb. N.	1944—1945		1945—1946		1946—1947	
	F. Y. M. Rs.	No F. Y. M. Rs.	F. Y. M. Rs.	No F. Y. M. Rs.	F. Y. M. Rs.	No F. Y. M. Rs.
(a) 0 N	15·41	13·26	22 89	21·66	25·22	26·30
(b) 50	13·55	12·60	21·81	21·31	23·88	26·48
(c) 100	13·73	12·29	20·92	19·80	23 42	24 00
(d) 150	13 69	12·46	23·96	21 02	26 06	26 00
(e) 200	14 24	12 67	25·12	22·43	25 83	25·96
(f) 250	14·03	13·01	24·66	23·44	26·10	27·60

IV. **Summary and conclusions.** With a view to determine the *optimum nitrogen requirement of sugarcane in the Anakapalle tract*, an experiment involving two major treatments (ten tons of farmyard manure per acre and no farmyard manure) and six minor treatments, (0 lb., 50 lb. 100 lb., 150 lb., 200 lb. and 250 lb. of nitrogen per acre) supplied in the form of groundnut cake was conducted over a period of three years in succession, 1944–'45 to '46–47. The variety of cane planted was Co 419. The results of the experiment indicate the following conclusions :

1. Application of farmyard manure did not influence the different phases of crop performance to any appreciable extent though the general indication was that it had some favourable effect. Under extreme conditions of drought its beneficial influence was more pronounced.

2. No significant effect of manures was noticed on germination of buds.

3. There was significant difference in growth due to minor treatments. Treatments (c) 100 lb. N and (f) 250 lb. N recorded almost similar heights. The rates of growth in the different treatments did not differ significantly among themselves.

4. Influence of manuring on the incidence of stem-borer was not significant.

5. The higher nitrogen treatments (e) 200 lb. N and (f) 250 lb. N yielded poor quality juice.

6. The maximum average yields of cane and gur were recorded by the treatment 100 lb. N (c), and the cost of production in this treatment was at a minimum.

7. From the point of yield, as well as cost of production per unit weight of cane, 100 lb. Nitrogen per acre, was found to be the optimum for sugarcane in this tract when applied in the form of groundnut cake.

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Some Observations on the Spread and Decline of Sugarcane Varieties in Madras, during the last fifty years

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Several cane varieties which were once the mainstay of the sugar and '*gur*' industry of this Province have either gone out of existence altogether or are now retained only in small-scale varietal collection plots on Research Stations. Some of these varieties occupied large areas for a comparatively long period while others could retain their importance only for a short period. This was due to several causes, natural, and artificial. It is proposed to present in this paper a historical review of the rise and fall of the important cane varieties till now cultivated on a large scale in this Presidency and to discuss the causes responsible for their replacement. Incidentally, the question, whether sugarcane varieties deteriorate in the physiological or genetic sense of the word is also dealt with here. The yield and other data from the Sugarcane Research Station, Anakapalle, are furnished for purposes of illustration.

It may be mentioned that unlike in other countries (6) the areas under different varieties in this Province are mere estimates. Only these approximate figures are avilable for judging the spread of varieties.

2. **Historical.** In the late nineties of the last century, when cane cultivation was not as extensive as at present, there was a furore in the East Godavari District that varieties under cultivation deteriorated and died extensively and that immediate Government aid was necessary to rehabilitate them. Dr. Barber, the then Government Botanist went into the matter and declared the cause of the failure of the crop to be due to the disease, Red Rot. It was then felt that among the steps to be taken to stem the tide of this and other diseases, the breeding of hardy hybrid canes suitable for the different tracts in this country was one of the foremost. After the establishment of the Sugarcane Breeding Station at Coimbatore in 1912, a stream of cane seedlings flooded the country. By selective breeding and introduction of the blood of wild ancestors like *Sacharum Spontaneum*, drought and disease resistance were introduced in the cane seedlings. Prior to the popularisation and spread of the seedlings i. e , till 1927, Purple Mauritius, J. 247, B. 208 and Java-Hebbal in the East-Godavari District, J. 247, B. 208 and Java-Hebbal in the Vizagapatam District, Striped and Ashy Mauritius, *Tellacheruku* and J. 247 in the North Arcot District, POJ 2878, J. 247 and Fiji B or Badilla in the

South Arcot District, 'Hotta Kabbu' 'Javari Kabbu' and 'Hullu Kabbu' in the Bellary District, were under extensive cultivation. Cultivation of Java-Hebbal, J. 247 and Red Mauritius was almost universal in the Southern Districts like Chittoor, Coimbatore and South Kanara. Besides these, Poovan, Vellai and a few other canes were also grown in the beginning of this century in the Coimbatore and adjacent districts.

Among the early releases of Coimbatore seedlings, Co 213 was the most important and spread extensively to many parts of this and other Provinces. By its introduction, cane cultivation was extended to areas previously considered unsuitable. Cultivation practices and ideas associated with the "*Noble*" type of canes (B. 208, Purple Mauritius etc.) underwent a radical change. The irrigation expenses were considerably reduced. During this period, POJ.2878 from Java, Co 243, Co 313, Co 349, Co 281 and Co 290 from Coimbatore also attained a certain measure of importance. The latter two varieties exist even now on a fairly extensive scale in the South Arcot and Bellary Districts (3). The popularity of Co 213 began to wane after about a decade and Co 419, introduced in 1934–'35 completely eclipsed it. This variety has now supplanted all other varieties and is the premier cane of the Province at present. Older varieties had some 'predilection spots' to which they clung for a longer time than in other places. This was due to certain natural and artificial causes influencing cane cultivation. It may not be far wrong to state that factory influence is sustaining the acreage under Co 281, as well as small areas under Co 349 and POJ.2878 in the South Arcot District. But Purple Mauritius which was liked for its jaggery quality and lack of spines on the leaf sheaths was retained till 1944, in the Ramachandrapur taluk of the East Godavari District. In the Peddapuram area of the East Godavari District, J. 247 and Co 213 occupied large areas till 1942 but both were swept away by the spread of Co 419. Co 313 was occupying a fairly large area (1000 acres) in the Vizagapatam District, (Bobbili area) till 1941 but gave place to other promising early canes like Co 527 and Co 421. Similarly B. 208 which was very popular in the Anakapalle tract of this district for its good quality jaggery is now grown only in small areas for chewing purposes. In the Bellary District, the *Hotta Kabbu* and others were displaced by Co 290 which in turn is rapidly yielding ground in recent years to the universal cane for this Province, Co 419. Similarly Red Mauritius in the Salem and South Kanara Districts is reported to be fast giving place to Co 419 and is being used more for chewing than for *gur* making. Thus there was a change of varieties periodically due to some reason or other; whether due to deterioration of the older varieties of the superior growth and vigour of the new varieties. The question, whether the sugarcane varieties deteriorate and if so whether deterioration is due to physiological or genetic causes, is discussed in the subsequent pages.

3. Asexual Propagation and Heterosis. Utilisation of hybrdi vigour of *heterosis* is the key to the successful evolution of better types of plants in vegetatively reproduced crops like sugarcane. Heterosis is known to increase as the disparity of the parental stocks increases. Unrelated autogamous varieties show more heterosis when crossed. This phenomenon was sought to be exploited in sugarcane breeding work, during the course of which widely differing genera and species *(Sorghum and Bamboo, Sacharum Spontaneum S. Arundinaceum etc.,)* were utilised. Since cultivation of the hybrid cane seedlings is almost universal in this Province, a study of their characters and causes for their replacement after some time, also means a study of the heterosis exhibited by the seedlings.

(i) Deterioration. Deterioration of seedling cane varieties will also mean loss of heterosis, in a way, as explained above. Earle, writing on sugarcane in Puerto Rico said that the soil rather than the varieties deteriorated. (Quoted by Noel Deerr in Cane Sugar, 1927) (4). East observed that loss of hybrid vigour was due to disease (5). Pal and Nek-Alam (10) reported that the expression of heterosis was greatly influenced by various external factors (season etc.) They quoted Bredemann and Henser (2) and Bolsunov (1) in support of their contention. Ramaiah and Ramaswami (11) assert that hybrid vigour can be maintained indefinitely, unless disease affects the plant. Luckwill (9) reported (according to Ganesan—1942) that heterosis might make its appearance at any stage of the life cycle of the plant. Kadam (8) lists the most important causes of supposed and real deterioration as (a) developmental variation, (b) mechanical mixtures, (c) mutations, (d) natural crossing, (e) minor genetic variations, (f) selective influence of diseases and (g) the technique of the plant-breeder. He particularly stressed that in vegetatively propagated crops like potatoes and sugarcane unwitting distribution of inferior bud mutations during a period of many years may lead to the serious deterioration in the quality and productivity of well-known varieties. Kadam's conclusion that diseases, rather than climate, play important roles in worsening a variety is applicable to sugarcane. Well-known instances are of Co 213 in the United Provinces and Purple Mauritius in this Province. That incidence of pests will also lead to deterioration in quality and yield of sugarcane is too well-known to need emphasis here (7).

(ii) Spotting of a genetically superior bio-type. The remarkable progress achieved by the sugar industry in this country is due to two causes. The primary one is the protection afforded by the Government by building a tariff wall against imports of foreign sugar. The second is the rapid progress in the evolution of superior types of cane seedlings from time to time to suit different localities and climates. An examination of varietal experiments at the Sugarcane Research Station, Anakapalle, clearly brings out that a particular variety found to be yielding best in a particular

period maintained its position only till a better-yielding variety was introduced and then it naturally yielded place to the new variety. For instance, from 1926 onwards when Co 213 was introduced, the importance of J. 247 waned. Co 213 yielded better and withstood adverse growth conditions extremely well, when J. 247 practically failed. Co 213 dominated the cane area only for a decade (till 1936). By then Co 419 was already multiplied. It was such a high-yielding cane that none of the varieties that were already tried or under trial then could approach it from the point of yield. This gradually replaced almost all the varieties under cultivation in this Province.

(4) **Discussion.** Data pertaining to four important varieties from the Sugrcane Research Station, Anakapalle, are furnished in the appendix to afford a comparative idea of their performance from year to year under identical conditions of crop growth except for seasonal variations. The crop on the Research Station was kept free from disease and the manurial and other cultural treatments were identical every year. The seed material for each year was grown on the same field for all the varieties and was kept scrupulously free from disease. It is clear from these figures that there was no definite downward trend in the yield or other economic characters of any particular variety. They indicate also that there was no deterioration of the variety as such genetically but that the fluctuations in yield and other characters were the result of seasonal effects. Thus an incidence of pests and diseases as a result of indifferent cultivation were responsible for the deterioration of cane varieties and introduction of superior seedlings was responsible for the replacement of varieties already under cultivation.

5. **Summary and Conclusions.** The performance of the more important cane seedlings grown in the Madras Province is reviewed in a general way from the point of their spread and decline. The causes for their deterioration and replacement are also discussed. The most important factor responsible for a variety to 'run out' seems to be the incidence of disease. Instances of inferior bud mutations or loss of heterosis due to other genetic causes were not noted in the case of sugarcane. Evolution of superior types of cane varieties from time to time was responsible for the replacement of once-popular cane varieties by others after some time.

6. **Acknowledgments.** I am grateful to Sri. N. L. Dutt, Sugarcane Expert, Indian Sugarcane Breeding-Station, Coimbatore, for his helpful criticism and valuable suggestions in the preparation of this paper. My thanks are also due to the Superintendent, Sugarcane Research Station, Aankapalle, for facilities afforded in preparing this paper during my stay at Anakapalle.

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Briquettes from Bagasse.— Tsuneo Tatsuno, pp. 104—109 (1947). Bagasse is carbonized either by dry distillation in a retort with recovery of methyl alcohol and acetic acid, or in a primitive bee-hive even as in the manufacture of wood charcoal; if expertly managed, the latter process is the cheapest. In either case the carbonized material is moulded with 20% of clay as a binder. The dried briquettes ignite very easily (at 208°C.), much easier than ordinary wood charcoal. The fuel value of the briquettes is 3960 KCAL. (Sugar Vol. 43, No. 7, July 1948, p. 49).

Some Aspects of Ratooning in Sugarcane

By

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1. Introduction.

Ratooning Sugarcane is the growing of successive crops from one year's planting after every harvest and is practised in many of the sugarcane-growing countries of the world, as for example in Louisiana, Mauritius, Cuba, West Indies, British Guiana and in Hawaii islands. In India the practice was not common due mainly to lack of suitable varieties, but the position has now changed, with the introduction of hardy seedling canes from Coimbatore. It has now become a general practice in many places to ratoon canes. In places like Valavanur in South Arcot District of this Province even seventh and eighth ratoon crops are being taken with the variety Co 281.

2. Area under Ratoons.

No reliable figures are available with regard to the area under ratoons. In the Season and Crop Reports (2) the percentage of area under ratoons is said to vary from 5·83 to 12·48% of the total area under sugarcane. In order to assess to a fair degree of accuracy the extent of ratooning that is practised, the area under plant crop and ratoon in a few villages in Gudiyatham taluk were ascertained. The figures are given below :—

TABLE I.

Serial No.	Year	Name of Village	Total area under cane in acres	Area under Ratoons in acres	Percentage area under Ratoons to total cane area
1.	1947	Thalayatham	94·90	45·22	47·64
2.	1944	Cheruvanki	97·64	49·45	50·64
3.	1944	Melalathur	31·69	9·03	28·49
4.	1944	Kil Vaithanankuppam	104·95	50·18	47·78
5.	1944	Mailpatti	73·35	44·72	60·96
6.	1944	Ithampet	87·98	56·72	64·48
7.	1944	Kailasagiri	70 25	41·59	59 20
		Total.	560 76	296 91	52·94

Thus the area under ratoons varied from 28·49 to 64·48% with an average of 52·94% of the total area under sugarcane. Dutt (7) has pointed that the percentage of area under ratoons has shown a considerable increase during the last few years, and the figure is now more than 30% of the total area under sugarcane.

3. The Present Position of Ratooning.

The reasons for the increasing popularity of ratooning is the saving in the cost of cultivation as the expenses towards preparatory cultivation and planting are avoided and also the ease with which a fairly good crop can be grown without taking the trouble of planting again. Yet opinions with regard to the economics of ratooning vary, and are sometimes even conflicting. Some experiments have already been done on this aspect in some Research Stations like Anakapalle, Palur, Samalkot and Gudiyatham in this Province and in Mushari in Bihar and Kalai in the United Provinces. In an earlier experiment done at Anakapalle (1934—'35) it was stated that the general growth of cane, density of crop, ripening, and tonnage are better in the ratoon crop than in the plant (3) while in a subsequent trial with a standard method of layout with the variety Co 419,' ratoons were found to yield less than plant crops and it was found economical to take only one ratoon crop (6). At Palur (1935—'36) ratoons were shorter and less in yield than plant crop and were also more susceptible to insect pests and diseases (5). At Samalkot thin canes were found to be better ratooners than thick canes (4). In Mushari. Bihar, no reliable conclusions could be drawn with regard to the growth and yield of cane owing to the abnormally poor crop (7). At Muzaffarnagar some indications were obtained that for ratooning the best time for harvest is late February or March. At Kalai it was possible to get as high yields from the ratoon crop as from the plant cane and the cost of cultivation of a ratoon crop was also much less than that of a plant crop. At Gudiyatham with increasing doses of manure the first two ratoons of varieties like Co 213 gave higher yields than plant crops.

4. Ratoon Experiment at the Sugarcane Research Station, Gudiyatham (1936—1939)

Three varieties Co 213, Co 414 and J. 247 were ratooned successively for three years and compared with a plant crop every year. The layout was 2 x 3 x 6 randomised blocks (split-plot design) with ratoon and plant crops as the main plot, and varieties as sub-plots, with six replications. The area of each sub-plot was 2 cents. The manurial doses were as given below:

Plant crops	...	150 lb. Nitrogen (100 lb Ammonium Sulphate and 50 lb. as groundnut cake.)
1st Ratoon	...	200 lb. Nitrogen (100 lb. as Ammonium Sulphate and 100 lb. as groundnut cake)
2nd Ratoon	...	250 lb. Nitrogen (150 lb. as Ammonium Sulphate and 150 lb. as groundnut cake)
3rd Ratoon	...	300 lb. Nitrogen (150 lbs. as Ammonium Sulphate and 150 lb. as groundnut cake)

All these were over a basal dressing of 10 tons farmyard manure and 2 cwts. superphosphate per acre.

Results: (i) *Yield.* The yields of cane from plant crops and ratoons of the different varieties are given below:—

TABLE II

Yield of cane in tons per acre.

	Ratoon crop.			Plant crop.		
	Co 213	Co 414	J. 247	Co 213	Co 414	J. 247
I. Ratoon	62·32	52·54	11·70	52·05	45·98	40·92
II. „	54·87	42·56	12·44	46·99	41·02	43·45
III. „	49·75	41·74	6·43	47·12	42·57	36·47

In Co 213, the first and second ratoon yields were significantly higher than their plant crops by 19·8% and 16·8%, but the yield in the third ratoon though 5·5% more than the plant crop, was not significant. Co 414 first ratoon was significantly more in yield than its plant crop by 14·2%, while the second and third ratoons were more or less similar. J. 247 first and second ratoons were very poor crops with only 28·6% of the yield of plant crops while its third ratoon recorded the lowest yield, being only 17·6% of the plant crop.

Co 213, a medium cane proved the best ratooning variety. Co 414, though a thick cane was also found to ratoon well, though not as good as Co 213. J. 247 was a total failure as a ratoon. It has to be noted that there was a gradual decline in yield in the case of subsequent ratoons, but yet even the third ratoon crops of Co 213 and Co 414. with increasing dose of manure were as good in yield as their plant crops.

(ii) *Number of canes per acre.* It can be readily conceded that the yield of cane from a plot or acre will depend upon the number of canes per acre and the individual development or weight of cane. The number of canes per acre, taking other conditions as normal, will depend on the germination and tillering or ratooning capacity of the variety. When the cane stool is harvested or ratooned, the tendency is for each of the underground portion of the secondary shoots as well as the main shoot to produce new shoots in turn. It is therefore reasonable to expect a larger number of shoots in a ratoon crop. This is borne out by the figures given below :—

TABLE III

Showing the number of canes harvested per acre

	Ratoon crop			Plant crop.		
	Co 213	Co 414	J. 247	Co 213	Co 414	J. 247
1st Ratoon	76,025	42,392	11,908	59,058	35,033	40,133
2nd „	68,967	32,700	10,300	56,892	31,542	37,600
3rd „	61,917	28,967	6,400	61,517	32,250	85,633

The number of canes per acre in the case of first ratoons of Co 213 and Co 414 were 28·7% and 21% respectively more than their plant crops. The number of canes in the second ratoon of Co 213, was also more by 21·3% while that of Co 414 was only 3·6% more than its plant crop. There was however a gradual decline in the number of canes per acre, with

successive ratooning, probably owing to the tendency for the older parts to die away. The period of profitable ratooning of any variety will therefore depend on this feature. Here again the unsuitability of J. 247 for ratooning was brought about by the miserably poor stand of the first, second and third ratoons which were only 29·7%, 27·4% and 18% respectively in number of the plant crops.

At Anakapalle the number of canes per acre of the first ratoons of certain varieties were said to be more than their plant crops (6). The results at Gudiyatham are in conformity with these results.

(iii) *Developmeut of canes.* It is a resultant of the length and thickness of cane, which in turn depends on the variety, soil, climate and conditions of growth.

(a) *Growth.* At Anakapalle (6) it was stated that ratoons receiving the same dose of 100 lb. Nitrogen as the plant crop were always shorter than plant crops. At Gudiyatham ratoons which received higher doses of manure than plant crops, (varying from 200 to 300 lb. Nitrogen), were not shorter than plant crops, but were even taller, except in the case of a poor ratooner like J. 247. Ratoons also made very vigorous growth in the initial stages.

(b) *Thickness of cane.* The average thickness of cane depends on the total number of canes per acre, and also on the manurial treatment. In the case of Co 213, 1st ratoon canes were definitely thinner, due presumably to an increase in the number of canes per acre, while in J. 247, ratoons were always thicker, owing to fewer number of canes.

(c) *Weight of Millable Cane.* This is the measure of the individual development of cane. In order to determine the difference in the development of plant crops and ratoons, the weights of millable cane were recorded for each sub-plot and the differences compared. The results are given below :—

TABLE IV

	Weight of Millable cane in lb.	S. E. of difference	
Co 213 Plant	1 995		
,, 1st Ratoon	1·838	0 055	Significant.
Co 213 Plant	1 848		
,, 2nd Ratoon	1·784	0·077	Not significant.
Co 213 Plant	1·719		
,, 3rd Ratoon	1·795	0·035	do.
Co 414 Plant	2·954		
,, 1st Ratoon	2·779	0·118	do.
Co 414 Plant	2·900		
,, 2nd Ratoon	2·818	0·157	do
Co 414 Plant	2·959		
,, 3rd Ratoon	3 221	0 067	Significant.
J. 247 Plant	2·344		
,, 1st Ratoon	2·121	0·147	Not significant
J 247 Plant	2 578		
,, 2nd Ratoon	2·702	0·128	do.
J. 247 Plant	2·286		
,, 3rd Ratoon	2·205	0 048	do.

It can be seen that though the 1st ratoon of Co 213 was taller than the plant crop, the individual weight of the ratoon cane was significantly less than the plant crop, owing to the increase in the number of canes and consequent thinness. The differences in weight between plant crops and 2nd and 3rd ratoons were not significant. Similarly in the weight of millable cane of Co 414 first and second ratoons, the differences were not significant, while the 3rd ratoon was definitely weightier and better in development than plant crop. Differences in weight between plant crops and ratoons were not significant in the case of J. 247. Thus it is seen that under favourable conditions, ratoons are capable of making even better development than plant crops.

As mentioned before, the yield of cane is a function of the number of canes per acre, and the weight of millable cane and this fact is brought out by the tabular statement below :- -

TABLE V

Treatments	Number canes % increase or decrease over plant crop	Weight of millable cane % increase or decrease over plant crop.	Yield of cane % increase or decrease over plant crop.
Co 213, 1st Ratoon	28 7	− 7·9	19 8
„ 2nd „	21·3	−3·4	16·8
„ 3rd „	0·7	+4·9	5·5
Co 414, 1st „	21·0	−5 9	14·2
„ 2nd „	3·6	−2·9	3·8
„ 3rd „	−10·0	+8·8	− 1 9
J. 247, 1st „	−70 3	· 9 5	−71·4
„ 2nd „	−72·6	+4·8	−71·4
„ 3rd „	−82 0	−3·5	−82·4

The increase or decrease in yield of ratoons over plant crop is more influenced by the number of canes, which is dependent on the ratooning capacity of the variety. Hence the success of ratooning depends upon the selection of a suitable variety that has good ratooning capacity, and giving it adequate manure for proper development.

TABLE VI

Frequency table of root system

	Co 213 Plant crop.			Co 213, 3rd Ratoon			Co 414 Plant crop.			Co 414, 3rd Ratoon.		
Class in inches.	Number of vertical roots.	Number of lateral roots.	Total.	Number of vertical roots.	Lateral roots.	Total.	Vertical roots.	Lateral roots.	Total	Vertical roots.	Lateral roots.	Total.
3"	70	...	70	55	..	55	26	...	26	61	..	61
9"	38	1	39	37	.	37	14	..	14	25	...	25
15"	12	..	12	27	1	28	10	.	10	48	2	50

Class in inches.	Co 213 Plant crop. Number of vertical roots.	Number of lateral roots.	Total.	Co 213, 3rd Ratoon. Number of vertical roots.	Lateral roots.	Total.	Co 414 Plant crop. Vertical roots	Lateral roots.	Total.	Co 414, 3rd Ratoon. Vertical roots.	Lateral roots.	Total
21"	10	1	11	16	...	16	6	1	7	28	...	28
27"	6		6	9	.	9	3	3	6	12	2	14
33"		1	1	4	3	7	1	2	3	4	2	6
39"	3	1	4	3	1	4		1	1	6	1	7
45"	1	1	2	1		1	3	3	6	2	2	4
51"	2	1	3	2	2	4	1	2	3	1		1
57"		1	1	1	3	4	3	1	4	3	1	4
63"		.	..	1	1	2	1	.	1	1	1	2
69"	..			.	1	1		1	1			.
75"		.		.				1	1	1	..	1
81"			.			.		1	1	.	.	...
87"								1	1	..	.	..
93"							.	1	1	..		
Total Nos	142	7	149	156	12	168	68	18	86	192	11	203
Total lentgth of roots			1368"			2067"			1014"			2856"
Weight in ounces			3¼			2¼			3¼			2½
Height of cane in inches			119			122			127			137

(iv) *Root system.* Roots have a direct bearing on the growth of any plant as they are not only the anchors, but are also the feeders. The root-systems of plant crops and ratoons were studied in the plant crops and 3rd ratoons of the varieties Co 213 and Co 414. The root-systems were exposed intact by carefully removing the soil around the roots. Both the lateral and vertical roots were traced and their number, length and the depths to which they extended were noted. An exact diagram to scale of the root systems was also drawn, which is appended. The data presented in Table VI will bring out clearly the better root-system of ratoons as compared with the plant crop. The number, length, and depth, to which the roots penetrated were greater in ratoon than in the plant crop. Nearly two-thirds of the total number of roots were confined to the first 15 inches and the roots extended to a depth and length of 7¾ feet. Root development was best in Co 414, 3rd ratoon, in which the growth and development of cane was also the maximum. As the ratoons have a better root-system, it is only natural to expect them to make quicker and even better growth, provided they are adequately manured.

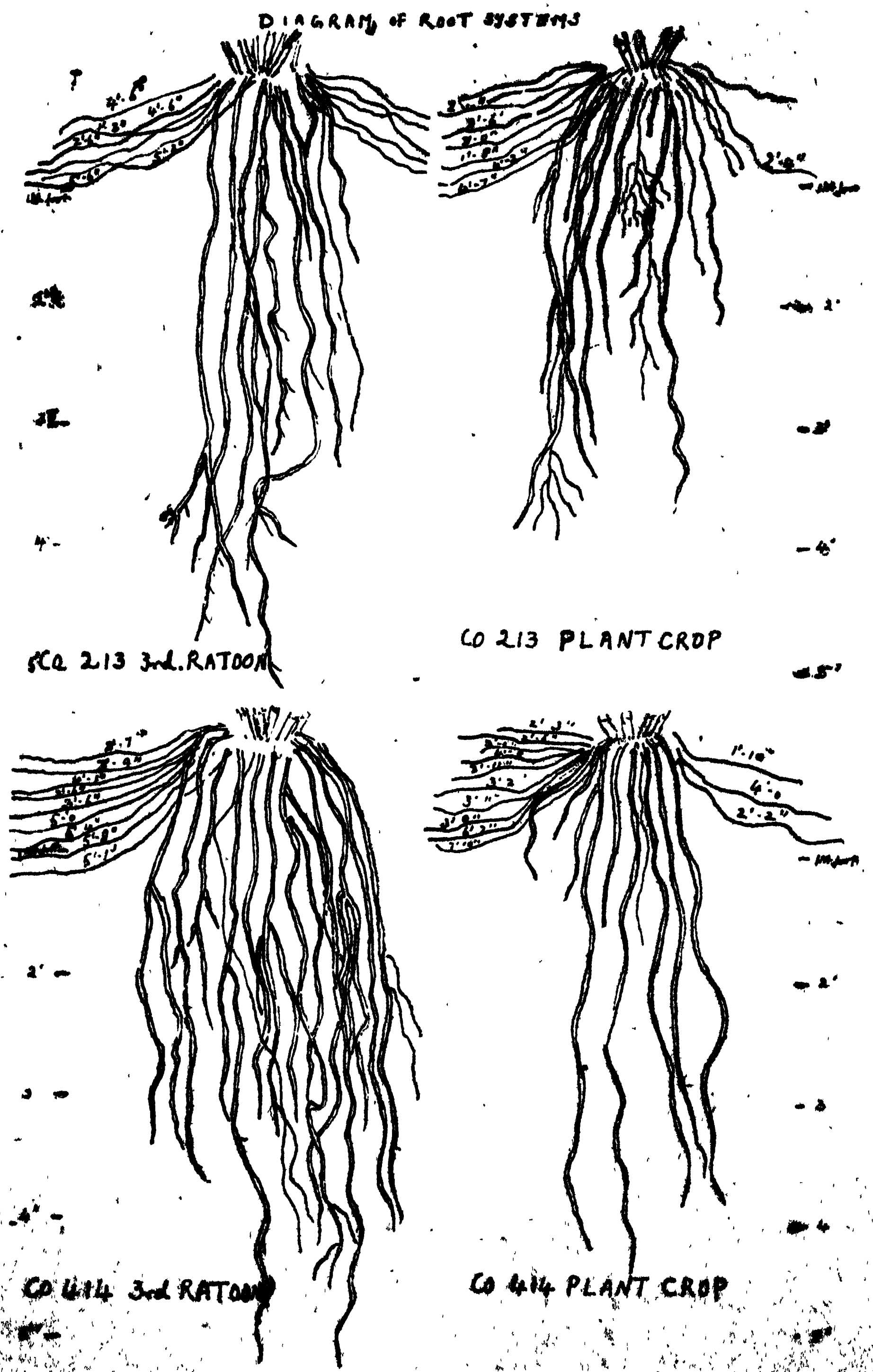
DIAGRAM of ROOT SYSTEMS
CO 213 3rd. RATOON
CO 213 PLANT CROP
CO 414 3rd RATOON
CO 414 PLANT CROP

TABLE VII.

Juice quality and jaggery recovery in plant and ratoon crops

Treatments	% Sucrose during					% Purity during					% Jaggery to Cane	Yield of Jaggery in tons per acre
	Oct.	Nov.	Dec.	Jan.	Feb.	Oct.	Nov.	Dec.	Jan.	Feb.		
Co 213, Plant	...	8.20	11.00	11.79	14.49	..	65.24	74.52	76.78	84.26	11.53	6.00
Co 213, 1st Ratoon	...	8.21	10.12	11.42	13.24	...	66.48	74.08	76.33	82.24	10.79	6.72
Co 213, Plant	7.68	11.11	12.40	11.13	16.65	64.97	75.06	78.47	86.34	87.14	12.27	5.77
Co 213, 2nd Ratoon	8.36	9.57	13.08	14.85	15.50	67.85	71.42	81.23	84.94	85.59	11.43	6.27
Co 213, Plant	9.14	11.26	12.79	15.50	15.68	70.50	77.59	81.79	86.18	87.28	11.09	5.23
Co 213, 3rd Ratoon	8.91	10.15	11.54	14.97	13.55	71.36	76.25	77.23	87.02	84.82	11.81	5.87
Co 414, Plant	..	11.04	14.41	14.77	15.77	...	74.78	82.08	82.69	84.70	12.46	5.73
Co 414, 1st Ratoon	..	12.52	14.09	15.07	14.85	...	76.52	81.96	83.58	83.96	11.80	6.20
Co 414, Plant	11.61	14.29	16.43	18.80	17.65	75.51	81.66	84.18	87.54	86.48	12.93	5.28
Co 414, 2nd Ratoon	12.20	15.19	16.46	17.15	16.91	75.70	83.35	85.78	87.44	86.24	12.40	5.31
Co 414, Plant	13.51	13.15	15.35	17.95	17.97	81.41	79.16	84.07	88.35	86.98	11.89	5.05
Co 414, 3rd Ratoon	12.59	13.35	14.89	15.88	16.37	80.13	82.58	84.43	85.29	85.25	11.63	4.85
J. 247, Plant	..	7.04	9.17	11.46	12.47	...	60.85	69.16	77.27	80.97	10.05	4.11
J. 247, 1st Ratoon	...	9.04	9.09	12.30	13.84	..	67.85	68.93	80.24	83.89	11.32	1.32
J. 247, Plant	5.28	7.38	9.72	13.41	15.75	53.22	63.19	70.96	82.83	86.50	11.85	6.15
J. 247, 2nd Ratoon	6.97	7.86	12.43	15.19	16.38	60.49	65.07	79.27	85.37	87.08	11.70	1.46
J 247, Plant	7.33	8.53	11.73	14.92	15.63	63.80	67.69	77.49	85.23	86.54	12.61	4.59
J. 247, 3rd Ratoon	9.36	9.82	11.32	15.27	12.54	70.86	72.59	75.93	87.22	75.23	11.33	0.73

Ratoons of Co 213 and Co 414 showed a lower purity and jaggery recovery than their plant crops owing to the higher dose of Nitrogen which the ratoons received. But deterioration started by February *i. e.*, a month earlier in the ratoons than in the plant crop thereby showing that ratoons mature earlier than their plant crops. However, the total jaggery yield based on cane weight and recovery was about 12% more in the case of Co 213 ratoons. Co 414 first ratoon was 8% more in yield than the plant crop.

(vi) *Pests and diseases.* There is a general belief that ratoons are more susceptible to insect pests and diseases than plant crops, but the results obtained at some of the research stations are rather varied. Among the pests of sugarcane, borers, *e.g.*, early side-shoot borer (Argyria sticti craspie H), top borer (Scirpophaga Nivella F.) and the internode borer (Diatroea Venosata W), mealy bugs, Pyrilea and termites are the most important in this Province Early side-shoot borers which attack the crop in the early stages, are not considered serious, as the crops revive by better tillering or production of new shoots in the place of attacked ones. Top borers bring about the death of cane out-right as they burrow into the apical growing shoot and are therefore a serious pest. Internode borers, though they do not kill the cane, cause appreciable reduction in juice quality. Pyrilla or the leaf hopper is not such a serious pest in South India as in the North. At Palur, 52% of ratoons were said to be attacked by borers while the damage to the plant crop was only 10%. Cane-fly and mealy bugs were more in ratoon plants (5). At Anakapalle the Pyrilla attack was said to be more severe in ratoons in 1934—'35 (3) though their incidence was said to be more in plant crops in 1941—'42. Mealy-bug attack was more severe in ratoons, while in the case of borers, except during 1943—'44 plant crops showed a decidedly higher percentage of borer attack (6). At Gudiyatham the incidence of borer attack was generally more (10 to 33%) in ratoon (Table IX). Mealy-bug attack was also more in ratoons. The percentage of borer attack in the third ratoon was also higher than in the first and second ratoons. Among the fungus diseases, Smut (Ustilage Scitaminea Syd) was found to be the most serious of the diseases. Smut which can be easily recognised by the terminal portion of cane turning into a whip-like structure was found to be definitely on the increase in the ratoon crops and the third ratoon of Co 213 had a very severe infection. The reduction in the number of canes in subsequent ratoons can also be partly due to the removal and burning of all the affected clumps. Of the three varieties (*viz.*) Co 213, Co 414 and J. 247 under trial, Co 213 was the worst infected with Smut while both the plant and ratoon crops of Co 414 were free. It is remarkable that the variety Co 414 although by the side of a heavily smut-infected crop of Co 213 was absolutely free from smut. The causes for the greater susceptibility ratoons of certain varieties and the comparative freedom of other varieties deserve special investigation and it is possible that the smut problem in ratoons could be solved by the selection of suitable resistant varieties.

However, in localities where the smut has assumed serious proportions, ratooning should be stopped and the disease should be controlled by roguing and burning of affected clumps, planting of healthy setts from a locality where there is no infection.

TABLE VIII

Showing the percentage of top-borer attack

	Ratoons			Plant Crop		
	Co 213	Co 414	J 247	Co 213	Co 414	J 247
1st Ratoon	18·6	24·5	19·4	20·0	19·8	16·2
2nd Ratoon	27·9	25·4	16·3	19·1	23·5	16·5
3rd Ratoon	31·9	37·8	25·4	19·1	26·5	18·5

(vii) ***Cost of Production of Cane.*** The cost of cultivation of cane for the plant crop and ratoons along with the cost of production per ton of cane are given below :—

Variety	Plant crop	1st Ratoon	2nd Ratoon	3rd Ratoon
	Rs A. P.	Rs. A P.	Rs. A. P	Rs. A P
	Cost of cultivation and harvest per acre.			
All varieties	+286 6 0	238 3 4	* 290 0 8	243 10 2
	Cost of production per ton of cane.			
Co 213	5 15 7	4 3 3	5 1 7	5 3 0
Co 414	6 10 3	4 12 3	6 13 0	6 0 1
J. 247	7 0 7	17 4 8	25 5 0	36 8 8

N. B. - (a) Cost of cultivation above refers to pre-war rates during 1937 '38 to 1939- '40.

(b) Cost of cultivation excludes rental value of land.

(c) The figures for the plant crop is the average of the cost of production for three years.

(d) * Cost of cultivation of 2nd ratoon is high owing to greater expenses involved in lifting and tying up lodged canes.

Cost of cultivation as shown above is naturally reduced in the case of ratoons to an extent of about 15 to 17% as there is a saving in expenses towards preparatory cultivation and planting. Except in the case of J. 247, where the yield of ratoons was very poor, the cost of production per ton of cane was less in ratoons. The cost of production was less in first ratoons by about 30%, as increased yields, were obtained with less of cultivation costs. It was economical to take even a third ratoon of Co 213 and Co 414 though the margin of difference between plant crop and subsequent ratoons got narrower.

5. **Future Lines of Work.** (i) It is clear that varieties differ greatly in their ratooning capacity, hence a search for better varieties, which possess good ratooning capacity has to be pursued in Research Stations and their profitable period of ratooning worked out.

(ii) The reported low yields of ratoons with similar dose of manure as plant crop at Palur and Anakapalle, and the higher yields of the first two ratoons with increased doses of manure at Gudiyatham, show that ratoons need heavier manuring and the optimum dose of manure required for ratoons has to be worked out.

(iii) The greater susceptibility of ratoons to insect pests and fungus diseases require investigation with special attention on the ultimate economics and effective control measures.

Smut appears to be the most important fungus disease affecting ratoons and as certain varieties are found to be resistant to smut, selection of resistant varieties which are desirable from other economic factors also would be a desirable line of investigation.

(iv) The best time to harvest the parent crop to be ratooned, so that the ratoon may get the best conditions for growth, deserves a special study.

(v) Harvesting the crop to be ratooned flush to the ground level or as low as possible is said to give vigorous sprouts. This aspect also needs investigation.

(vi) As ratoons mature earlier than a plant crop, if suitable early varieties themselves can be ratooned, the sugar factories can well start their work nearly a month in advance; work in this direction deserves attention.

(vii) The practice of burning cane trash *in situ* after harvest is rather a general practice with ryots and this is done mainly with the idea of saving the cost of labour involved in clearing the trash. This practice is believed to be harmful as it leads to loss of humus in the top soil and it may be advantageous not to burn the trash, but to compost them and return to the soil. The scientific and economic aspects of this have to be worked out to bring out the points of advantage and disadvantage more clearly.

(viii) The residual effects of ratoons on soil fertility need also investigation and a proper rotation has also to be worked out.

6. **Summary and Conclusions.** A brief review of the work done on ratoons is made and the experiment on ratoons at the Sugarcane Research Station, Gudiyatham, has been discussed in detail.

It was noted that varieties differ greatly in ratooning capacity and with increased dose of manure, the first two ratoons gave higher yields, than plant crops. It was economical to take third ratoon crops also, as the yields were similar to the plant crop, with a saving in the cost of cultivation.

As ratoons mature earlier than plant crops, they can take the place of early varieties in factory areas.

Ratoons were found to be more susceptible to insect pests and also to smut.

Future lines of work on various problems affecting ratoons are indicated.

7. **Acknowledgment.** The work done at Gudiyatham and reviewed here was subsidised by the Indian Council of Agricultural Research and the author acknowledges his grateful thanks to them. Acknowledgments are also due to the kind permission given by Sri R. Vasudeva Rao, Sugarcane Specialist, Anakapalle for making use of the data and for his helpful criticism.

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Agrarian Reforms

(Evidence tendered to the Agrarian Reforms Committee)

By

K. C. RAMAKRISHNAN

Tenancy Problem.

There are various systems of land tenure in the Province – Zamindari, Inamdari, Ryotwari, Jenmi, Mulgeni, etc. — the first two of which are disappearing.

Except in Malabar and S. Canara where the Kanamdar and the Mulgeni tenants are a sort of under-ryots, standing between the ryots and the actual cultivators, we have no statutorily recognized under-ryots in the Province. In big estates of individuals or of institutions like Devasthanams, there are big lease-holders sub-leasing the land to smaller tenant-cultivators. But generally ryots deal with cultivators directly.

Rents in the case of cereal crops, paddy on wet lands and millets on dry lands, are partly determined by custom and partly by the fertility of land and water supply. Share rents, and also fixed leases in kind, vary from one-third to two-third of the gross produce and are based largely on the above considerations and partly on the contribution made by the landowners towards cost ot cultivation. Share system, which is more common in the southern districts, is generally confined to poorer tenants, and depressed classes, while fixed leases are taken up by more solvent tenants. Commercial crops like sugarcane, plantain, cotton, tobacco and groundnut are leased out for fixed amounts of cash to quite solvent tenants, who can take care of themselves. They look more to rise in prices than to increase of yields for theit profits. Rents of these crops are determined more by forces of supply and demand and prices ruling than by custom or by the will of the landlord.

Enhancement of rent is attempted at the time of renewal, if prices have risen at the time or have a prospect of rise. This is the reason why the term of tenancy is often as short as one year. Tenants are not keen in increasing the yield, lest it should lead to rise in rents.

Remission in rent is seldom given by any landlord completely. Abatement is common when the rains fail badly and there is no source of irrigation. It is generally followed by all renters in the whole village and is seldom an individual act. It is a common practice in such circumstances for fixed leases to be converted into *waram* or share-leases with abatements according to losses by weather or pests. Still it amounts to a serious loss to the cultivator who may not be able to recover the costs of his cultivation – even though it is a mercy that the landowner does not insist on his pound of flesh.

Compensation for improvements effected by tenants is a problem arising in long-term tenancy, as in Malabar, and seldom affects the short-term tenants unless it be for residual value of certain manures applied.

The incidence of rents is best studied in relation to net income and not as a share of the gross produce as cost of cultivation varies not only with the nature of the soil and water supply but with the nature of the crop. One uniform rate would be unfair, if related to gross produce and not net-income. This is recognised in the Ryotwari revenue settlement in the case of standard crops.

A land tribunal representing different interests is a good idea, but it may not function in a democratic manner in villages, where one or a few big landlords are dominant and cannot be challenged by those who depend on their favour. The tribunal should be allowed only a limited latitude in fixing up fair rent, which should have some relation to net income and not gross produce. The estimate of not only the latter but of the costs of cultivation must be made by an impartial agency.

Economic Holding.

This is interpreted in various ways. Foreign writers mean by it an extent of holding which offers the maximum return on the capital and labour ready to be invested on land by a cultivator, be he an owner or tenant. In India it is not so much capital but labour available in the family of the cultivator that is taken into account by economists Many of our writers, however, mean by an economic holding that which would offer enough for the subsistence of the family, whether it offers full employment or not. But whatever the interpretation, the extent of holding would vary with the nature of the crop and the intensity of its cultivation. Extreme examples at two ends would be millets and betelvine. Paddy, cotton, plantain, sugarcane, tobacco, chillies, vegetables, etc., come in between.

Village self-sufficiency is out of the question. Regional self-sufficiency may be attained except in case of crops requiring special kinds of soil, climate, water, skill and markets. All crops cannot be grown with equal ease in every region. But the orgy of transport, especially in bulky vegetables, fodder, etc., must be stopped.

An economic holding must provide, in any case, enough to maintain the cultivator and his family at a standard of living which satisfies the nutritional needs, including protective foods, which would sustain them on health and strength and promote efficiency—though any form of luxury might not be provided for. But it is difficult to draw a sharp line between where necessity ends and luxury begins in the case of clothing, if not also of housing. It may not be easy to get the needed income from the

cultivation of the holding alone, as in most cases there is a long off-season when nothing can be done on the land. A part of the income would have to be derived from the pursuit of some occupation allied to agriculture—such as dairying, poultry-farming, bee-keeping or some other industry such as hand-spinning.

Holdings, especially on wet land or irrigated area, are badly fragmented. Consolidation of holdings would mean a great convenience to the holders of the land, though its claims are often exaggerated. Consolidation is comparatively easier to effect if land is homogenous, but enlargement up to the economic size is very difficult. But supposing this were done by carving out bits of land from big holders and adding them to sub-economic holdings, would it be possible to retain the economic-holdings intact from generation to generation in the face of the operation of the law of equal inheritence among all sons? Even the reclamation of land on a large scale, for which chances are remote, or the industrialisation of the country, which would take time, cannot absorb the existing surplus labour on land. Intensity of cultivation by irrigation and otherwise may absorb a few. Meanwhile population grows.

More men might be employed, to be sure, if women labour were banned or discouraged on land—as has been the tendency in prosperous countries. But as it is, for the cultivation of a number of crops more women labour is employed than men labour on the whole, particularly in operations like weeding, transplanting and picking—operations in which the machine has made the least inroads in India.

Maximum limit to the size of holding may be prescribed in the case of mere rentiers but not such as to discourage experiments in large-scale farming by owners themselves, as has been carried on in Coimbatore District in recent years, though control over payment of wages and working conditions may be exercised by the State. It is better to encourage the purchase of additional land to round off uneconomic holdings—by means of easy loans, subsidy, advice, etc.

Co-operative Farmimg.

This term is variously interpreted; but it is best to confine the use, of the term to joint farming carried on as a co-operative concern by agriculturists, who divide the produce according to the members' contributions in the shape of land, capital and labour—the value of which is assessed at market rates. Rights of private property are recognised and ownership is paid a dividend. Labour is paid for according to the quantity and quality of work done — not according to needs but according to services rendered. This distinguishes it from Collective Farming, which is ruled out under conditions in India.

But even Co-operative Farming is far from easy to carry on. In fact, of all forms of co-operative activity, it has been found to be the most difficult. A number of experiments have been made in different parts of the world, but nowhere has it been a conspicuous success except among Jews in Palestine, who have made a success of it in the face of difficulties, inspired by an extraordinary passion to settle down in the country and backed up the Jewish National Agency supported by the prosperous Jews of the world. Indian ryots are poles asunder from the Jews in Palestine -in respect of education, industry. self-sacrifice, communal harmony, etc. The report of the Indian Delegation to Palestine makes it clear that none of the factors of success in that country is present in India and warns that Co-operative Farming in areas already cultivated would not be a feasible proposition — because of the land-laws and systems of land tenure and the individulistic attitude of the Indian farmer. The Delegation suggested the feasilibility of settling landless labourers on state or other cultivsble land to be reclaimed and run on the lines of the Small Holders' Co-operative Settlements in Palestine.

There is a longing not only for individual possession but individual cultivation of land, not only in this country but in all countries. This is the raison d'etre of colonisation schemes and small holders settlements in Europe—to settle landless labourers as independent tenants and would-be peasant-proprietors allowing them to pay the cost of land and of equipment in several instalments.

The whole co-operative structure in countries most advanced in co-operation is built on the foundation of peasant-proprietorship and individual cultivation as well as possession ; only it is supplemented by group effort in purchase, processing, sale, etc. This strong inclination for individual cultivation is observed in the so-called joint farming societies of Madras and Bombay. Co-operation is confined to the getting of credit and of leasing of land in common, which is sub-divided and let to tenant members for cultivation individually. Even in the newer colonisation societies where land is granted to landless labourers and ex-servicemen, though joint cultivation has been held up as an ideal, few are willing to take it up in practice. Even the little bit of common land allotted for the public park is neglected in colonisation societies of ex-servicemen in the Coimbatore district.

Thus the case for Co-operative Farming has not been established. Can it be argued that because our holdings are small and fragmented, the remedy is Co-operative Farming, carried on on a large scale ? What are the economics of such large scale farming, not conducted by one dominant person, but with the consent of so many small folk ? By all means, consolidation and even enlargement of holdings up to an optimum size may be attempted. It can be done more effectively by compulsion which is

the method adopted by other countries rather than by co-operation, which is far too slow a method as has been proved in the Punjab and elsewhere in India. But the reconstituted holdings are better entrusted to old owner-cultivators or let on lease to competent tenants on fair rents and with fixity of tenure.

The utmost extent to which land reform could go in the conditions of this country is perhaps what is propounded by Mr. Tarlok Singh in his *Poverty and Social Change* — pooling all the small and fragmented holdings in the village, reconstituting them into compact holdings of different sizes to suit different families of cultivators, be they old owners or tenants; all these to pay fair rents to the joint village exchequer as fixed by the joint village management, on which all owners and cultivators are represented and which plans cropping schemes etc.

Co-operation and Compulsion.

As already stated, consolidation of holdings, badly fragmented, is effected better by some sound measure of compulsion than by co-operation where the consent of every one concerned is required. That is the method usually adopted outside India. Only the consent of a majority of landholders holding the greater proportion of the land in the village is required; if that is obtained, the cantankerous minority is obliged to fall in.

A similar consent of a majority is required in the constitution and working of Marketing Boards in Britain and some of the Dominions, by which the produce of even the dissentient minority will have to be sold through the Marketing Boards, representing the interests of growers, traders and consumers. It is not left to any individual to sell his produce as he pleases.

Co-operative credit may be fostered indirectly, by the courts refusing to recognise transactions of money-lenders of less than, say, a sum of Rs. 1,000/- to agriculturists, leaving only bigger agriculturists to resort to money-lenders - co-operative societies coming to the rescue of all the smaller agriculturists.

Supply of pure and improved seeds, for which there is a growing demand, can best be done through co-operative credit societies; but departmental supply alone is insufficient. Seed-farm societies must be developed on an adequate scale and all their surplus seeds should be delivered to co-operative credit and supply societies for sale to members. A rapid multiplication of village societies (one for a group of villages) as recommended by the All-India Planning Committee on Co-operation is essential though the target fixed is rather ambitious.

Dual-purpose societies, especially credit and supply, are more feasible than multi-purpose societies combining all functions. They may pass on produce for processing or sale to special societies located at commercial centres with wider jurisdiction and greater resources. Village societies cannot by themselves take up processing and sale ordinarily.

As for manures, apart from the supply of oil-cake and fertilizers by co-operative societies, pressure should be brought to bear on cultivators to grow green manure after the cereal crops, wherever possible, with free supply of water. Wherever possible, supplementary wells may be dug for the purpose. The use of cow-dung as fuel must be penalised. The use of nightsoil in inoffensive forms as manure should be encouraged. This is the greatest waste going on in India, while every scrap of such manure is said to be conserved and used in China and Japan.

Even if co-operative farming is not so easy to work, every endeavour should be made to persuade growers to deal as far as possible with co-operative societies for their requirements of credit, supply of seeds and manures and implements and for processing and sale of produce. In Palestine a great deal of importance is attached to these forms of co-operation by individual settlers as well as co-operative settlements. They are all very loyal to the *Hamashbir* which acts as a co-operative wholesale and the selling agency for certain types of produce.

Minimum Price of Agricultural Produce

It is difficult to guarantee the prices of even one or two major crops. Rice is the most important crop in Madras and it governs the prices of millets and a few other local crops. An attempt may be made to assure a minimum price for it according to quality, based on the cost of cultivation, cost of living of producers and the purchasing power of masses of consumers, though the interests of both are not easy to reconcile. The Government should have complete control of imports of rice and its storage and be prepared to release imported rice at a minimum price and buy up local paddy at a maximum price. Buffer stocks must be carefully guarded against loss and it is better to store the same as paddy, not as rice.

Prices of commercial crops like cotton and groundnut are determined by forces far beyond the control of Government and are best left alone in normal times. Perishable articles like milk, eggs, vegetables and fruits are not fit objects for price control as no buffer stock can be built up by the Government or co-operatives. The demand is growing for these specialities and would grow faster if prices were brought down by increased yield and lower costs of production and marketing, for which state-aid may be given.

Agricultural Indebtedness.

Debt Relief Legislation in Madras and the recent rise in prices have helped the bigger agriculturists more than the smaller ones. Tenants and agricultural workers not only derived no benefit from the legislation but have been hard hit by the recent rise in prices; because what little of rise in income they got was more than neutralised by the rise in prices of goods and services they have had to purchase. A positive increase in the extent of their indebtedness has been revealed by the Economist's report on Rural Indebtedness in Madras.

Co-operative credit has not been of much avail to people without land, especially to agricultural labourers. It is only a missionary agency that can help them with credit and recover it at times when they can have a little savings as at harvest time. Perpetual vigilance and active sympathy are needed, which are not forthcoming from Panchayatdars of co-operative societies. Short-term and long term co-operative credit can help the small landholders. But it would be wise in several cases to help them sell some of their fragments of land at the present ruling prices than keep the debt on for a long period of time, when prices might fall.

'Controlled credit' through the supply of seeds, manures, implements, cattle etc., can work better, if it is stipulated that the produce raised should be sold through the lending society which will pass on the produce for sale to the nearest marketing society to which it is, or should be, affiliated. Such an arrangment would help not only landed classes but also tenants, though agricultural labourers may not benefit by it.

Minimum wages for agricultural workers.

It is a laudable aim to assure minimum wages to workers. But it is not easy to enforce payment. This has been the experience of countries which have enacted legislation, as practice lags behind law. There are long periods of unemployment on land, when labour is often prepared to work for fewer wages than prescribed by law, while in busy seasons, especially at harvest, demand for labour is in excess of supply and wages rise even when labour is not well organised. In India most farms are small and scattered, employers are petty, and labour is depressed and unorganised and therefore has little bargaining power. Just at present labour is getting more organised and vocal and making demands which petty owners of land find it difficult to concede. The agitation has succeeded more in raising the share of share-croppers than raising the wages of labourers—though this has also been achieved without effort in times of acute demand for labour.

'Forced labour' — as found in Padiyal system in Tamil districts— has lost much of its rigour in recent times on account of facilities of

communication, and opportunities for employment in new industries and plantations. If still the system continues, it is due to the modicum of protection offered to such labour in the slack season and the totality of perquisites of all kinds available.

Taxes on Land and Agricultural Incomes.

The abolition of the Zemindari system and its conversion into Ryotwari system will bring about uniformity in the system of taxing land. The system of land revenue assessment in the ryotwari areas is not free from defects. The following reforms are suggested :—

(i) It is certainly more correct to levy a tax on the net income than take a share of the gross produce. But this must be done not only with reference to 'Standard crops' — paddy on irrigated land and some millet on dry land — but the yield of commercial crops, their value, their cost of cultivation and net income derived should be estimated and the tax imposed according to the area under cultivation and the prices of such crops year after year.

(ii) There need be no one rate of tax payable all through a long period of 30 years during which there may be booms and depressions. The tax must vary according to net income as in the case of industrial and professional ineomes. Fear of discontent at frequent changes in the amount of tax payable need no longer be entertained ; the equity of the variability of tax according to income will be appreciated. There is the difficulty of estimating cost of cultivation. But rough costing will have to be done for more than one season with the help of the Agricultural and Revenue departments.

(iii) The rate of land revenue on dry land is low in the case of commercial crops like cotton and groundnut ; it is ridiculously low in the case of lands under well irrigation, where the result of improvement effeeted by the land owner in the shape of wells, embankment, etc., is not charged at all for all time. It will be no bar to improvement if the exemption from taxation of the effects of improvement is restricted to a period of 30 years or 40 years (as is done in the Punjab).

(iv) The rate of tax on gardens or topes on dry or garden land might vary with the annual rental value of the different kinds of fruit trees, which now pay a low rate.

(v) The basic tax on land might be a flat rate and not exceed 12½ per cent of net income taking into aecount the ruling prices of produce and costs of cultivation. In these days of quick changes it is meaningless to take into aceount prices of previous twenty non.famine years for commutation.

(vi) There is no need to exempt small holdings from taxation as the basic tax of 2 annas in the rupee of net-income will not be felt oppressive. The tendency to split up holdings on inheritance should be checked.

(vii) Cesses for local bodies may be super-imposed at a rate not exceeding 12½ per cent on the basic-tax i.e. two annas in the rupee). Tangible returns in the shape of local services should convince the tax-payers of the justice of this additional levy.

(viii) A graduated income tax may be imposed — in addition to basic tax and cessess—on all agricultural net-incomes exceeding Rs. 3,000. If due accouut is taken of the investment on land and permanent improvements. and a fair return expected on such investmant in arriving at net incomes, then the tax will not be felt oppressive.

Compost from Bagasse. Yoshi Iwata and Toe Shiang Wu, pp. 119—26. Bagasse was treated for two weeks with lime and water, mixed with either ammonium sulphate solution or animal excrement as bacteria nutriment and piled. The piles were turned several times in a period of 170 days, by which time the material was sufficiently decomposed. NOTE:— This suggests a way for avoiding the nuisance of large quantities of cane trash left out on the fields after harvest, and a means of maintaining the humus content of the soil. Let someone invent an efficient method for picking up the trash and removing it to a convenient nearby location for composting. The artificial manure thus produced could be returned to the field between the cane rows and incorporated with the soil during ordinary cultivation. The operation will cost something but thorough experiments and engineering cultivations might show a profit. (Sugar Vol. 43, No. 7, July 1948, p. 59).

An Agricultural Tour

By

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(Second year.)

The annual tour of the second year students this year was confined to a fourteen days visit to the southern districts of the Province from the night of 31st October. The Blue Mountain Express steamed off with 40 budding agricultural officers, who began to feel certain that their long expected tour had actually commenced.

Nellikuppam, our first destination was reached next evening. We were comfortably put up at the "Amaravathi Palace" the owner of which received us kindly by arranging a dinner party. The Palur Agricultural Research Station was then visited where we had been given full details of various items of work done there. The total area of this farm is 55 acres. After this, the sugarcane fields, a laboratory for rearing of insect parasites, and the sugar factory of Messrs. East India distilleries and Sugar. Ltd. were visited by us.

On 3rd, Wednesday, we left Nellikuppam and we had enough time to visit the Annamalai University on our way to Aduthurai. There, our young cameramen began to put their heads together to get a good picture and finally obtained a birds eye-view of the University Buildings and the town from the top of the famous Sastri Hall.

Aduthurai was reached in the evening and we stayed in the rest house in the Agricultural Research Station. The Superintendent took us round the paddy fields, orchards etc. and gave us full information regarding the various strains of paddy evolved there and their distribution in the Presidency. A nice tea party was given to us by the staff of the station but unfortunately we didn't return it since we had to leave the place on the same day. Entraining at Aduthurai Railway Station in the morning, we reached Kodai Road in the evening of the 5th. Soon after our arrival we drove to Pattiveeranpatti which is about 17 miles from Kodai Road. Mr. Sountharapandia Nadar was kind enough to accommodate us in his Guest Bungalow and he took us round his extensive lands under the Grapevines, Mangoes, Paddy etc. explaining to us all the details of their cultivation and their economics. Many distinguished visitors have paid him glowing tributes. An excellent exchange of dinners were arranged between himself and ourselves. The hospitality and affability of Mr. Nadar and his sons put us at our ease and every convenience was very solicitously attended to throughout our stay there. Our pleasant stay here will always be a memorable one for our class. During our stay here we also visited a plantain garden near the riverside.

On, the 7th morning the Kodai Observatory which is about 7,800 ft. high was reached after a pleasant journey by bus. The students evinced a keen interest in seeing and knowing the workings of the various apparatus kept there, Photo-Heliograph and the Milneshaw Seisnograph were particularly very interesting. Our cameramen played an important part here in having all the beautiful new things into their small cameras. After this we returned to our halting place at Pattiveeranpatti.

Madura was reached at noon on the 8th and leaving our luggages in the station itself, we started for the inspection of the sewage farm. The luxuriantly grown guinea grass and the efficient underground drainages are worthseeing. The farm though mainly started to dispose of the sewage water and ensure the sanitation of the colony is now a source of good profit to the Madura Municipality. The farm commands an area of about 138 acres with a soil of light sandy loam, very suitable for sewage irrigation. The clear drained water from the farm collects in a tank from where it is utilized for the paddy fields and for cattle.

The next important visiting place was Koilpatti which was arrived on the 8th night. On the following morning the red soils of the Agricultural Research Station was visited by us.

On the 10th morning we went to Ettayapuram by bus and visited the lands of the Jamindar who was kind enough to receive us with a light tea party. He himself explained to us everything in a nutshell about his lands, cultivation and the working of the improved mechanical seed drill. The famous "Bharathi Memorial Hall" was also included into the cameras of our students.

The black cotton soil of the Agricultural Research Station, Koilpatti, which is within a stone's throw from the Bungalow where we stayed was visited next. The superintendent of this station explained to us the various experiments carried out in the farm, the agricultural practices of the tract and the departmental improvements effected therein. The superior variety of cotton of that tract, the practice of growing cumbu after cumbu were noteworthy features. Our activities at Koilpatti concluded with a football match on Wednesday evening against the Local High School Team which ended in a goal-less draw.

We reached Tenkasi at dusk on the 11th and with the help of the local Agricultural Demonstrator, we were accomodated in a good bungalow at Courtallem. The natural and pleasant sight of the lower Falls and the Five Falls were very much enjoyed by the party. The cameramen among us were very busy in making the falls enter into their cameras. When we just entered the mango gardens up the hills, an unfortunate accident of a snake-bite to a student, made us to retrace our steps to our lodgings. Fortunately everything went allright.

At Ellangi we met Sri Akilandam Pillai who kindly furnished us with useful information about the mango cultivation on the hills of courtallam. He gave us a good tea-party after his interesting lecture.

Saturday the 13th was spent in a long journey from Tenkasi to Coimbatore and we arrived our Headquarters on the 14th morning with a warm welcome from our collegues in the hostel awaiting us. During the tour we utilised every visiting hour to the best advantage.

The local authorities in all places were extremely kind and did their utmost not only to explain the details of work but also to help the party in the matter of lodging and boarding. We tender our grateful thanks to them for their uniform cordiality and courtesy.

HINTS TO FARMERS

Insect pests of sugarcane. Sugarcane is a crop singularly free from the attacks of any serious pests in S. India. One of the most serious is the white ant, which comes immediately after planting. The use of fresh and undecomposed manure and trashes like planting of setts from the bottom portion of canes, precipitates this trouble. The admixture of crude-oil or tar-oil emulsion in the irrigation water and proper attention to manuring and the selection of setts will remedy this evil.

A few borers, commonly known as the Early shoot—and Top shoot-borers cause some amount of damage during certain years. No direct control measures can be advocated for these. The release of ***Trichograma parasites*** which destroy the eggs of the borers has been tried and reported succesful at Nellikuppam. The Mysore Dept. of Agriculture advocates a light earthing up as soon as the setts germinate and again about 3 weeks later.

Occasionally the cane-fly, Pyrilla also increases in enormous numbers. The young and adults of this insect have been very successfully controlled by dusting with 5 per cent Gammexane dust.

Insect pests of paddy. *Paddy.* Paddy is subject to the attacks of a large number of insects. One of the most serious and wide spread is the Paddy stem-borer. The caterpillars cut the ear-head stalk almost at the soil level causing 'white ears'. Usually the insects would be present even in the earlier stages when it is easily over-looked. The use of light-traps during the early hours of dark nights, will serve to destroy large numbers of the adult moths and prevent the further spread of the attack.

Another equally serious and wide-spread insect is the Rice-bug which sucks up the grain contents before it hardens. It has been recently found that dusting with Gammexene 5 per cent dust protects the crop till the grains harden.

This year, a paddy insect usually considered as of very little importance, the paddy green jassid, a dark green, wedge-shaped, small active insect developed in great numbers in certain paddy tracts and did considerable damage to the tender crop before anything could be done. It has now been satisfactorily controlled by sprays of 0·1 per cent D. D. T. in water.

The 'paddy mealy-bug' or 'soorai' is another serious insect enemy of paddy, which is becoming extremely wide-spread. Investigations are in progress to evolve satisfactory control measures. In addition, there are innumerable insects attacking paddy, some assuming greater importance in certain areas and others in other places. The use of mechanical methods of control, like netting will serve to check the trouble, if adopted early enough.

Important Diseases of Sugarcane in S. India. *Red rot.* The disease is càused by a fungus (*Colletotrichum falcalam*). The disease is prevalent in all sugarcane growing areas of the Province. It is difficult to detect the disease in the field in the early stages, but the following symptoms manifest themselves when the crop is in an advanced stage. The leaves wither and the stem shrivels and shrinks and the affected plants dry up.

The damage to the crop is depended on the number of clumps affected. One splitting open the cane of an affected plant, the characterestic symptom of the disease are seen viz., red blotches, with a white centre transversely elongated, are noticed in the lower internodes. A sour smell is also characterestic of the disease.

Control measures. The disease is propagated mainly through planting infected setts. Therefore only disease free setts should be used as planting material. As waterlogging in the fields helps the development of disease, adequate drainage facilities should be provided in all cane fields. Steeping the setts in 1% Bordeaux mixture prior to planting will reduce chances of soil infection.

Smut. The disease is caused by the fungus *Ustilago Scitaminea.* The smut disease of sugarcane is a limiting factor in cane production in many parts of the Province, especially in areas where ratooning is practised. The disease is easily recognised in the field. The production of long whip-like dusty black shoots, is characterestic of this disease.

The disease is chiefly propagated by planting infected setts, and a certain amount of secondary infection also occurs by the spread of infection in the fields through spores produced in the smutted shoots.

Control measures. The prompt removal of the entire infected clump is necessary to prevent secondary infection. Careful selection of setts, from disease free clumps, will greatly reduce chances of primary infection. Steeping the setts in 1% Bordeaux mixture will also help in reducing infection.

Sett rot. Caused by the fungus *Ceratostomella pardoxn.*

Setts for planting, sometimes, show a blackening, as a result of invasion of the fungus, and the germination of such setts is affected. Treatment with 1% Bordeaux mixture is effective in controlling sett rot.

Rice diseases. ***Stem rot disease of rice—Sclerotium oryzae.*** Stem rot disease of rice caused by Sclerotium oryzae has been known to occur in all paddy growing areas in the Province, but as a rule the disease affects

only a very few plants in the late stages of the crop and consequently the damage caused by it is not great. The disease was therefore considered to be of minor importance in our Province and no attempts were made to tackle it. During this year, however, the disease assumed serious proportions in some parts of Tanjore District affecting the *Kuruvai* and *Ottadai* crop and causing certain amount of damage.

Symptoms of the disease. The presence of small dark spots on the outer sheaths of the plant at the waterline are first indications. As the disease progresses the submerged portions begin to rot in the affected plants and the culm shrinks and ultimately collapses, causing the plants to fall over and lodge. The tillers arising from the base of infected plants die. In mild cases the disease may not kill the plants, but the earheads formed are only partially filled. The plant is sickly with yellow leaves. If a diseased culm is split longitudinally, the basal portion is found to be infected with the fungus. A weft of mycelium is produced in the hollow of the stem, and small black sclerotia* can be seen dotted all over the inner surface. The presence of sclerotia is characterestic of this disease and enables one to distinguish stem rot from other diseases like foot rot, which also affect the base of the stem. The fungus enters the plant through the base of the culm in the region which is under water and invades the tissues of the plant causing rotting of the stem.

How does the disease spread. The sclerotia are the fruiting bodies of the fungus. They are capable of remaining in a dormant stage for a long time, and germinate and infect the plants when conditions are favourable. Normally, when the plants are vigorous the fungus is not capable of doing much damage to the outer sheaths alone being invaded by the fungus, but when the plants are weakened by other causes such as spells of drought, inadequate manuring or lack of aeration, the fungus is able to penetrate the inner tissues and cause stem rot. In Tanjore this year, the conditions which led to the out-break of the disease would appear to be the following. (1) Inadequate water supply in the early stages of the crop, and (2) to some extent the weakening of the plants, caused by jassid infestation.

Control measures. Stem rot disease of rice is difficult to control. In Arkansan in America, control is effected by modification of irrigation methods. As the fungus gains entrance though the leaf sheaths in the submerged region, draining off excess water and allowing just enough water to keep the soil muddy, have been found to be effective in arresting the progress of the disease. But this may not be practicable in places where the supply of water is uncertain and is not recommended unless local conditions permit.

*Sclerotia — small dark coloured bodies of minute size but visible to the naked eye.

An application of Ammonium sulphate ½ to 1 Cwt. per acre has been found effective in stimulating the production of tillers, and overcoming the effects of the disease, in cases where the intensity of attack is not very great.

As the disease is carried over to the next season, through the stubbles in which the sclerotia are lodged, it is recommended that in all badly infected fields, the stubbles are removed and burnt after the harvest.

Hurried preparation of the land should be avoided and the field should be puddled well, and time must be allowed for the remnants of the previous crop to rot and disintegrate before transplanting is done.

Gleanings.

Plant Identification is an Important Service. The New South Wales National Herbarium has received 240 duplicate specimens of South American plants to add to its collection. Many of them are species not previously represented in the collection. They include a large number of leguminous plants, and ten species of Lantana new to the Herbarium's records. Plant identification is an important service to Australian farmers. It helps to keep a check on the accidental introduction of plants known to be pests, or which may become so under Australian conditions. There is also an increasing interest in new plants, especially pasture grasses or grasses likely to be useful for the control of soil erosion. It is a curious fact that Australian farming rests on the successful cultivation of crops, fruits and grasses imported from other parts of the World. Many imported plants have done much better in Australia than in their original environment, and it is quite likely that among the specimens recently obtained from South America may be some that will eventually find a useful place, not only in the Australian Herbarium, but also among the pastures and cultivated crops of the future. (Agricultural Newsletter No. AGN/225).

Once-a-Day Milking. A Queensland dairy farmer has startled the Australian dairy industry by maintaining that once-a-day milking is a good commercial proposition that will reduce dairy production costs. Mr. and Mrs. C. E. Tudor, who have a Jersey stud at Gayndah, Queensland, say that from actual practice over a period of years, they have proved that a good living can be made from dairying if cows are milked once daily and fed on good pastures and crops. Stall feeding is only necessary when pastures are unbalanced, and there are no crops. With twice-a-day milking, so the Tudors, a farmer spends about seven hours daily with his cows. He does not have time to grow all the feed he needs and has to pay high prices for lucerne and grain. Under their scheme, the cows are finished in the morning and the rest of the day is left free for farm-work. There is little difference in the butterfat yield of a cow with once-a-day milking. Milk supply is a little less but this is offset by the amount given over the whole lactation period, which is extended. The Tudors milk freshly-calved cows twice-a-day for six weeks, then put them on to once-a-day milking.

New Potato Does Well. Monak, a new variety of potato bred by Mr. J. G. Carrol plant-breeder of the New England Experiment Farm, Glen Innes, New South Wales, has done well in official trials, yielding two tons a acre more than Factor and Katahdin, the varieties usually grown in the district. The trial crop was planted on July 21, 1948, and harvested on November 10. A complete fertilizer mixture was supplied at the same rate to all plots, and all varieties had to contend with a dry spring. Yields of varieties in the trial, calculated to the nearest half ton were:—

	Tons.
Monak	8½
Mainguy	7½
Factor	6½
Sequoia	6½
Sebago	6½
Moona	6
Aussie	5½
Katahdin	5½
Seedling 2511	5½
Seedling 2507	4½

Monak is a cross between Pontiac and Katahdin. It matures a little later than Factor. It has large round white smooth-skinned tubers with shallow eyes and is blight-resistant. Moona, another new variety in the trial, is a cross between Factor and the American variety Saranac. With Monak and seedlings 2507 and 2511, it was bred at Glen Innes by Mr. Carrol.

Scientists Tackle Citrus Problem. Australian research workers are tackling the problem of finding a practical method of ridding citrus orchards of boron, where it is believed to be present in excessive and toxic quantities. Many citrus trees in the Mildura irrigation area of north-western Victoria have displayed an affection of the leaves known as 'tip-burn'. For a long time this was thought to be a disease. Then it was supposed that 'tip-burn' was caused by salt in the soil, brought to the surface by continued irrigation. This salt theory has not yet been disproved, and investigations are continuing both at Mildura and on the Murrumbidgee Irrigation Area, in New South Wales. Meanwhile, an alternative explanation has been suggested by the discovery that boron in toxic quantities is present in the soil of places where 'tip-burn' is prevalent, and where an almost total absence of soluble salts proved that salting was not causing the symptoms. If this is confirmed by further investigation, it may be necessary to devise some method of neutralising or 'fixing' the boron in the soil. The alternative would be the long and costly process of developing citrus strains with a high resistance to boron in abnormal quantities. (Agricultural Newsletter: No. AGN. 224).

Bananas Now in the Can. Queensland banana growers are looking forward to increased production and prosperity now that the fruit marketing cannery at Banyo, Queensland, Australia, has produced canned bananas. Following extensive experiments, the factory has developed a method of processing which produces canned bananas that are not affected by bacteriological action and retain practically 100 per cent of their natural colouring and characterestic flavour. Previously bacteriological action and colour deterioration had prevented canning. A trial pack of 8,000 dozen tins of bananas has been placed on the market to test public demand. Successful canning of bananas will mean stabilisation of prices and increased demand as excess supplies can be taken off the fresh fruit market. Queensland, where the canning process has been developed, grows only 6,00,000 bushels of bananas a year, a small proportion of the total Australian crop. The most productive area is the north coast of New South Wales, where 4,600 farmers between Tweed Heads and Nambucca River, have total plantation areas of 30,000 acres from which they harvest 2,500,000 bushels of bananas a year. Besides these, they grow tropical fruits—pineapples, pawpaws (paw pia), passion fruit, avocados—with side crops of beans, tomatoes, peas and sweet potatoes which altogether return them £A-3,500,000 annually. (Agricultural Newsletter. No. AGN. 220).

Apple-thinning Hormone Sprays. Promising results are being obtained in Australia from experiments with sprays to regulate or thin apple and par crops. Trials carried out by the Horticultural Division of the New South Wales Department of Agriculture during the last two seasons have used various sprays containing the hormone preparation 2, 4—D, and the commercial product Methoxone. These 2, 4—D sprays gave the best results particularly with Granny Smith, Democrat and Delicious apple trees. Depending on the strength of the spray, either all the young fruit was removed or all fruit from weak spurs removed, leaving fruit, often thinned out to singles, on strong spurs. In rare instances, the spray killed the weakest spurs but this loss of weak spurs which hardly ever set fruit is not considered a disadvantage. Where the spray was used to remove fruit from the tops of Granny Smith trees, fuit on the lower parts of the trees was undamaged and was exceptionally well-grown and uniform in size. Thinning effected by sprays applied in 1946 promoted blossoming in 1947. Australian apple and pear growers have been warned by agricultural authorities that tests are still in early stages and recommendations are only made for experimental purposes. They emphasise that the strength of sprays must be regulated to the variety and vigour of individual trees, and that pears and sensitive apple varieties require sprays of low strength, which means that growers who decide to use the hormone spray method of thinning must be prepared to carry out a certain amount of experimental work in their own orchards or consult district fruit officers. [Agricultural Neweslетter: No. AGN/225].

New Cool Chamber for Eggs, Fruit & Vegetables. A cool chamber which keeps eggs, fruits and vegetables fresh and odourless for periods of months, is an Australian invention, now being marketed in Melbourne, Victoria. Inventor is Mr. V. Holmquist of Boondarra Road, East Street, Kilda, who is a specialist in the commercial use of activated carbon. The new cool chamber requires only two gallons of water daily, and once installed there are no other costs of upkeep. The principles of the invention are the use of activated carbon to absorb food odours with water circulation and air currents maintaining the food products in good condition. The characterestics of activated carbon enable it to absorb carbon dioxide gas which is given off by fruit in storage. The substance used is actually activated charcoal, processed by the marketing company for use in the cool chambers.

In combination with flues built into the chamber and the walls, backed with carbon, all odours from fruit and vegetables are absorbed, and the food products are kept fresh and in a natural state. The cool air which passes through the watered carbon circulates throughout the chamber, and assists in the general operation. No expensive upkeep is required for the domestic type of cool chamber which is now being marketed, and the

water, a gallon or so, is replenished each day. A system of syphons at the top of the chamber provides for the continual water circulation through the built-in carbon. The cool chamber, which is built of galvanised iron, is 27 inches long, 21½ inches wide and 40 inches deep, and sells at £A 25. It is intended to be placed outside the house, so as to gain the full benefit of the air circulation. Tests conducted by the inventor show that oranges and other citrus fruits remain fresh for periods of up to six months. Bread will keep fresh for a week, and vegetables and milk do not use their qualities after months of storage.

Larger units 6 ft. x 6 ft. x 6 ft. 6 ins., are being extensively used by poultry farmers in Victoria for storing eggs. This model is sold at £A 100. A report by the inspector's section of the Australian Egg Board states that the claim made by the manufacturing company that eggs could be held for long periods in association with commodities like citrus fruit, onions and vegetables, had been proved by experimental tests. After four months' observation it was found that the eggs (of export quality) had not absorbed any odour or flavour. To meet the requirements of citrus growers and orchardists generally, the company also markets a large unit 12 ft. x 8 ft. x 8 ft., at £A 300. It is claimed that the results are an improvement upon refrigeration, as the fruits are not affected in their taste qualities, after long periods of storage—a result which the company claims cannot be obtained by usual refrigeration. A fourth application of the principles of the invention is a very small cool chamber which can be fitted into the orthodox Ice-box to absorb the usual food odours through the activated carbon. [Agricultural Newsletter No. AGN/226.]

Extract

Sugarcane—Pineapple disease of sugarcane (Ceratostomella paradoxa) is the major cause of failure of cane sets to germinate in Mauritius, often causing serious economic losses, especially under drought conditions and in cooler uplands. Experiments by treating the cane sets with organic mercury compounds before planting, have given satisfactory results. The ends of the cane sets were dipped into a 1% or 2% solutions of organic mercury compounds like Aretan, Agrosan, Verdasan, Abavit, or Ceresan and planted them in infected soils. Some cane sets were dipped in dry lime. Some of the plots were irrigated and a few were not irrigated. For control untreated cane sets were also planted. When germinated plants were examined later, untreated plants showed 68·87% infection, whereas 1% solution treated plants showed not more than 10% infection Aretan was the best of all the organic mercury fungicides used. A 2% solution of Aretan treatment reduced the infection to 3·67% and in all cases a 2% solution of the organic mercury compound was better than 1% solution. Treating the ends of the cane sets with lime did some good and the infection was still 29·67%. The experiments further showed that the disease was especially prevalent under dry conditions. The infection was 42% less on the irrigated than on the unirrigated controls. (Sugar Vol. 43, No. 7, July 1948, p. 52).

Agricultural College and Research Institute Library, Lawley Road, Coimbatore.

MONTHLY LIST OF ADDITIONS FOR DECEMBER, 1948

1. Association of British Insecticides: Directory for 1948 — 1948
2. Association of Vitamin Chemists: Methods of Vitamin Assay — 1947
3. BLAU (Greda): World Fibre Survey — 1947
4. BOWER (F. O.): Botany of the Living Plant Edn. 4. — 1948
5. BURREL (R. C.): Organic Chemistry for Students of Biological Sciences — 1948
6. CHANDRASEKHARA IYER (S. N.) & PARTHASARATHY (S. V.): Handbook of Botany for India by K. Rangachari, Revised Edn. 4 — 1948
7. CHOUDHURY (Sudhir): Plant Diseases and their Causes — 1948
8. COLINS (Edward C.): Elements of Geneties — 1947
9. COMMON-WEALTH Agricultural Bureau: List of Research Workers in the British Commonwealth — 1947
10. COMMONWEALTH Ecommic Committee: Dairy Produce — 1948
11. ——————— Plantation Crops — 1948
12. ——————— Vegetable Oils and Oilseeds — 1948
13. COOK (M. T.): Virus and Virus Diseases of Plants — 1947
14. DUMMIER (E. F.) & HEFLEBOWER (R. B.): Economics with applications to Agriculture Edn. 2. — 1940
15. FAWCETT (H. S.): Citrus Diseases and their Control Edn. 2. — 1936
16. GOLDSCHMIDI (Richard): Physiological Geneties — 1938
17. GUPTA (Satish Chandra Das): Cow in India, 2 Vols. — 1945
18. HARVEST Gold—Caltex petroleum products — 1948
19. HOAGLAND (D. R.): Inorganic Nutrition of Plants
20. INDIAN SUGAR INDUSTRY MANUAL for 1947—'48 — 1948
21. ISLEY (DWIGHT): Methods of Insect Control P. I and P. II — 1948
22. JATHAR (G. B.) & BERI (S. B.): Elementary Principles of Economics Edn. 5 — 1948
23. JOHNSON (B. C.): Methods of Vitamin determination — 1948
24. KOMHATKAR (V. Y.): Reconstruction of Indian Agriculture — 1946
25. MANIAN (E. V. S.): Handbook of Textile Industry — 1948
26. MURNECK (A. E.) & WHYTE (R. O.): Vernalisation—a symposium — 1948
27. NAUDE (C. P.): Production of Nicotine sulphate from Tobacco waste — 1947
28. ONTARIO Agricultural Department—Annual Report for 1946 — 1947
29. PIGOU (A. C.): Income — 1948
30. ——————— Socialism vs. Capitalism — 1948
31. RAMIAH (K.): Rice in Madras — 1947
32. RILEY (Herbert Barkes): Introduction to Cytogenetics — 1947
33. SAKSENA (R. D.) Handbook of Crop Pests — 1948
34. SHAH (K. J.) Communications — 1948
35. ——————— Engineering Industries — 1948
36. ——————— Industrial Finance — 1948
37. ——————— Chemical Industries — 1948
38. ——————— National Planning: Principles and administration — 1948
39. ——————— Rural and Cottage Industries — 1948
40. ——————— Soil Conservation — 1948
41. SUMMERS (E. M.) etc.: Mosaic of Sugarcane in U. S. — 1948
42. TICKELL (F. G.): Examination of Fragmental Rocks, Edn. 3 — 1948
43. WHITEHEAD (Stanley B.): Gardners Earth — 1945
44. WHYTE (R. O.): Farming for Industry — 1948
45. WOODMAN (H. E.): Rations for Livestock Edn. 11 (eleven) — 1948
46. WRENCH (G. T.): Reconstruction by way of the soil — 1946

Crop and Trade Report.

Cotton Raw in the Madras Province. The Receipts of the loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1948 to 7th January 1949 amounted to 355,946 bales of 400 lb. lint as against an estimate of 283,700 bales of the total crop of 1947—'48. The Receipts in the corresponding period of the previous years were 406,165 bales. 504,288 bales mainly of pressed cotton were received at spinning mills and 33,171 bales were exported by sea while 115,668 bales were imported by sea mainly from Karachi and Bombay.

Statistics—Crop—Sugarcane—1948—Intermediate—condition report. The condition of the sugarcane crop is generally satisfactory in all the districts of the Province except in Anantapur, Chingleput, North Arcot, Salem and Ramnad Districts where the crop has been affected adversely due to inadequate rains during the growing period and the yields are expected to be below the normal. The crop had a set back in the early stages due to the attack by insect pests in parts of the Vizagapatam District but has since revived.

2. The wholesale price of jaggery per imperial maund of 82-2/7 lb. (equivalent to 3,200 tolas) in the important market centres in the Province on the 18th December 1948 was Rs. /17—13—0 in Erode, Rs. 17—10—0 in Tiruchirapalli, Rs. 15—13—0 in Salem, Rs. 14—10—0 in Vizagapatam, Rs. 13—1—0 in Coimbatore, Rs. 12—8—0 in Mangalore, Rs. 12—6—0 in Cuddalore and Vellore, Rs. 10—15—0 in Vizianagaram, Rs. 10—13—0 in Adoni, Rs. 10—11—0 in Rajahmundry, Rs. 9—7—0 in Chittoor, Rs. 8—10—0 in Bellary and Rs. 8—4—0 in Kakinada. When compared with the prices published in the last report i.e., those which prevailed on 6th November 1948, these prices reveal a rise of approximately 20 per cent in Salem, 16 per cent in Vellore, 14 per cent in Chittoor, 10 per cent in Bellary, 9 per cent in Tiruchirapalli, 8 per cent in Cuddalore and 7 per cent in Vizagapatam and a fall of approximately 30 per cent in Adoni, 29 per cent in Coimbatore, 9 per cent in Kakinada and 7 per cent in Rajahmundry, the prices remaining stationary in Vizianagaram, Erode and Mangalore.

Statistics—Crop—Castor—1948—First and final report. The average area under castor in the Madras Province during the five years ending 1944—'45 represents 18·2 per cent of the total area under castor in India. The area under castor in the Madras Province upto 25th November 1948 is estimated at 230,800 acres. When compared with the area of 230,500 acres estimated for the corresponding period of last year, it reveals an increase of 0·1 per cent. The estimate of last year was less than the actual area of 240,700 acres by 4·1 per cent. The crop is grown on a large scale in the districts of Guntur (23,900 acres), Kurnool (33,300 acres), Bellary (18,100 acres), Anantapur (57,400 acres), Nellore (43,200 acres) and Salem (17,200 acres). The area estimated for the current year is the same as that of last year in the districts of Kurnool, South Arcot, Ramnad, Malabar and South Kanara. An increase in area is estimated in the districts of East Godavari, Krishna, Bellary and Tanjore and a decrease in area in the other districts of the Province due mainly to want of timely rains. The decrease in area is marked in Anantapur District (—1,600 acres), Cuddaph District (—2,400 acres), Nellore District (—2,800 acres) and Salem District(—1,500 acres).

The yield per acre is expected to be normal in the districts of East Godavari West Godavari, Krishna, Nellore, South Arcot, Chittoor, Madurai, Ramnad, Tirunelveli and Malabar and below the normal in the other districts of the Province. The seasonal factor for the Province as a whole is estimated at 94 per cent for the normal. On this basis, the total yield is estimated at 21,200 tons as against 21,800 tons estimated for the corresponding period of last year. The wholesale price of castor seed per Imperial maund of 82-2/7 lbs. or 3,200 tolas, as reported from important market centres on 17—12—1948 was Rs. 24—13—0 in Nandyal, Rs. 23—1—0 in Guntur, Rs. 21—1—0 in Vizianagaram and Rs. 14—2—0 in Bellary. When compared with the prices which prevailed on 20—12—1947, these prices show an increase of 15 per cent in Nandyal and 4 per cent in Bellary and a decrease of 13 per cent in Vizianagaram and 6 per cent in Guntur.

Weather Review—For December 1948.

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	Nil	−0·5	36·0
	Calingapatam	Nil	−0·5	33·1
	Vizagapatam	0·6	+0·1	29·7
	Anakapalle*	Nil	−0·9	35·5
	Samalkot*	0·4	+0·1	40·7
	Kakinada	0·4	−0·3	49·7
	Maruteru*	Nil	−0·6	33·4
	Masulipatam	0·3	−0·3	37·9
	Guntur*	...	...	...
	Agri. College, Bapatla	0·5	−0·2	33·1
	Veeravanam (College Farm)	... §	...	32·8
Ceded Dists.	Kurnool	Nil	−0·2	22·4
	Nandyal*	Nil	−0·4	27·8
	Hagari*	Nil	−0·3	22·5
	Siruguppa*	Nil ‡	−0·1 ‡	21·6
	Bellary	Nil	−0·1	22·8
	Rentichintala	Nil	...	26·6
	Cuddapah	Nil	−0·8	22·8
	Anantharajpet*	1·7	−0·6	25·1
Carnatic.	Nellore	2·5	−0·4	35·8
	Buchireddi-palem*	2·4	−1·1	30·6
	Madras	1·7	−3·7	34·1
	Tirurkuppam*	1·3	−7·2$	39·0
	Palur*	3·1	+2·7	61·8
	Tindivanam*	1·8	−2·5	31·7
	Cuddalore	2·6	−4·9	42·8
Central.	Vellore	0·5	−2·1	30·5
	Gudiyatham*	0·2	−2·2	27·8
	Salem	0·4	−0·6	31·8
	Coimbatore (A. C. R. I.)*	0·7	−1·3	20·0
	Coimbatore (C. B. S.)*	0·6	−1·6	23·1
	Coimbatore	1·1	−0·3	19·5
	Tiruchirapalli	0·5	−2·3	29·4

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	9·2	−1·7	44·8
	Aduturai*	3·2	−2·1	24·3
	Pattukottai*	3·0	−1·6	28·0
	Madurai	1·3	−0·7	22·9
	Pamban	9·8	+2·2	32·3
	Koilpatti*	0·3	−2·8	36·2
	Palamcottah	0·7	−3·1	30·4
	Amba-samudram*	3·2	−4·5	42·8
West Coast.	Trivandrum	0·4	−2·0	82·6
	Cochin	0·8	−0·8	109·2
	Calicut	0·6	−0·4	119·9
	Pattambi*	Nil	−1·8	95·8
	Taliparamba*	0·7	−1·0	139·6
	Nileshwar*	0·1	−1·8	140·1
	Pilicode*	2·1	−0·5$	145·3
	Mangalore	Nil	−0·5	120·6
	Kankanady*	Nil	−0·6	117·9
Mysore & Coorg.	Chitaldrug	Nil	−0·5	32·1
	Bangalore	0·2	−0·2	39·4
	Mysore	0·1	−0·4	29·4
Hills.	Mercara	0·4	−0·3	143·4
	Kodaikanal	3·7	−1·5	73·8
	Coonoor*	11.1	+4.9	79·8
	Ootacamund*	..	...	...
	Nanjanad*	1·2	−0·6	73·1

Note:— (1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal.

(3) $ Average of six years for Tirurkuppam, and seven years for Pilicode.

(4) § The actual rainfall was 0·02".

(5) ‡ Taluk office rainfall being Nil for the month

(6) ... Figures not available.

Weather Review for December 1948.

A number of mild western disturbances occurred near Punjab and Rajputana.

On 31—12—1948 conditions became markedly unsettled in the extreme South-West Bay. An active western disturbance was found moving across North-West Punjab.

The weather throughout the country was practically dry.

In the Madras Presidency weather was almost dry during the first half of December 1948 except for the isolated mild showers in certain interior parts of Andhradesa, Tamilnad and Kerala. North-East Monsoon became active on 19—12—1948 along and near the Coromandal Coast. On the next day it was active throughout the Tamilnad. Then, again the weather became dry. Towards the end of the month, there happened to be some showers along South Coromandal Coast. But on the whole, though the North-East Monsoon started well, the total precipitation was poor with long spells of dry weather with the result that the crops dependent on rains including rainfed paddy suffered very much.

In most of the places the night temperature happened to be less than the normal particularly in the first half of the month.

The note-worthy falls in the Madras Province are as detailed below:—

S. No.	Place.	Date.	Rainfall in inches.
1.	Nellore	2—12—1948	1·5
2.	Madura	8—12—1948	1·0
3.	Negapatam	18—12—1948	4·4
4.	Kallakurichi	21—12—1948	1·7
5.	Cuddalore	,,	1·2
6.	Pamban	28—12—1948	2·2

M. B. V. N &. C. B. M.

OBITUARY.

We regret to record the death of K. V. Suryanarayanamurthy, who was lastly Marketing Assistant at Kakinada, on 19—1—1949 at his residence in Anakapalle at the early age of 27, after a prolonged suffering from Tuberculosis. He was a bright student of the Agricultural College, Coimbatore. He took his B. Sc. (Ag) degree in 1943. He served for a short time in the Nizam's Sugar Factory and later he joined the Agricultural Department first as Assistant in Chemistry at Coimbatore.

We offer our heartfelt sympathies to the members of the bereaved family.

Departmental Notifications

GAZETTED SERVICE—POSTINGS AND TRANSFERS

Name of Officers	From	To
Sri Govinda Rao, P.	Lecturer in Mycology, Bapatla,	Plant Protection Officer (Mycology) Bapatla
,, Gopala Unnithan, M.	D. A. O., Calicut,	Assistant Marketing Officer, Coimbatore
,, Gopala Menon, E. R.	Assistant Entomologist (Teaching) Coimbatore,	Plant Protection Officer (Entomology), Coimbatore
,, Krishnan, B. S.	D. A. O., Under Training, Guntur,	D. A. O , Ellore
,, Krishna Menon, K.	Assistant Mycologist (Erogt Scheme) Ootacamund,	Plant Protection Officer (Mycology) Coimbatore
Mohammad Basheer Sahib Bahadur,	Gazetted Assistant Lecturer in Entomology, Bapatla,	Lecturer in Entomology, Bapatla
Sri Mukundan, M.	D. A. O., Under Training, Calicut,	D. A. O., Calicut
,, Rama Mohan Rao, A.	(On leave),	D. A. O., Chittoor
,, Ramiah, P. V. (Rao Bahadur)	(On leave),	Principal, Agricultural College, Bapatla
,, Srinivasa Ayyangar, C. R.	Principal, Agricultural College, Bapatla,	Headquarters Dy. D. A., (Research) Madras
,, Subramania Mudaliar, V. K.	Headquarters Dy. D. A., Madras,	Regional Dy. D. A., Vellore
,, Subbiah, M. S.	(On leave),	Assistant Entomologist (Teaching) Coimbatore
,, Santhanam, K.	D. A. O., Under Training at Tanjore,	D. A. O., Cuddalore
,, Satagopan, V.	D. A. O., Cuddalore,	Assistant Marketing Officer, Madras
,, Thirumala Rao, V.	Lecturer in Entomology, Bapatla	Plant Protection Officer (Entomology) Bapatla

SUBORDINATE SERVICE—APPOINTMENTS

The following candidates are appointed to the posts shown against each :

Names	To
Sri Chandrayya Naidu (Nellore)	A. D., Rapur
,, Kanakaprasada Rao, K. (W. Godavari)	F. M., Cotton Breeding Station, Coimbatore
,, Koteswara Rao, K. (Krishna)	A. D., Avanigadda
,, Koteswara Rao, T. (Krishna)	A. D., Pattikonda
,, Ramasubbiah, K. (Bellary)	Cotton Assistant, Adoni
,, Rama Rao, P. V. (E. Godavari)	A. D., Chodavaram
,, Rangamannar, (Bellary)	A. D., Rayadurg
,, Subba Rao, P. (Guntur)	A. D., Cheepurupalle

POSTINGS AND TRANSFERS

Names	From	To
Mr. Ali Hyder Sahib, R.	A. D., Anakapalle,	A. D., Kudligi
Sri Ambikacharan,	A. D., Venkatagiri,	P. A., to D. A. O., Madras
,, Ananthapadmanabha Pillai, R.	D. A. O., Chittoor,	P. A., to D. A. O., Vellore
,, Ayyaswami Ayyar, T. V.	On leave	Srivaikuntam

Names	From	To
Sri Antoy, J. S. C.,	A. A. D., Tirukoilur,	A. A. D., Papanasam
,, Balasubramanian, R.	Plant Quarantine Inspector, Shenbaganur,	A. D., Melur
,, Dhamodhara Prabhu, M.	A. D., Mangalore,	A. D., Puthur
,, Duraiswami, K. N.	A. D., Attur,	A. D., Salem
,, Koteswara Rao, D.	Assistant Mycology, Coimbatore,	Assistant in Mycology, Bapatla
,, Kutti Mudali, K. S.	A. D., Salem,	A. D., C. M. P., Project Area, Tanjore
,, Lakshmipathi, S.	A. D., Chittoor,	A. D., Punganur
,, Narasimha Rao, T. L.	...	Assistant in Entomology, Anakapalle
,, Nagaeswara Sarma, D.	A. D., Tiruchengode,	A. D., Kandakur
,, Narayana Reddy, M. S.	Assistant in Cotton, Adoni,	A. D., Nandyal
,, Narasimha Reddy, R.	A. D., Pulivendla,	A. D., Prodathur
,, Narayana Reddy, B.	A. D., Vayalpad,	A. D., Ananthapur
,, Pitchayya, B.	Assistant in Paddy, A. R. S., Tirurkuppam,	F. M., Agricultural College, Bapatla
,, Rama Rao, M. V.	A. D., Sompeta,	A. D., Kurnool
,, Radhakrishna Rao, K.	Assistant in Entomology S. R. S., Anakapalle,	Plant Quarantine Inspector, Shenbaganur
,, Rama Rao, M.	A. D., Kudligi,	A. D., Rapalle
,, Ramasomayajulu,	A. D., Chodavaram,	F. M., A. R. S., Samalkot
,, Rama Rao, S.	(On leave),	A. D., Gudur
,, Rama Rao, V.	A. D., Nellore,	A. D., Venkatagiri
,, Raghavulu, G. V.	(On leave),	Marketing Assistant, Nagpur
,, Sankaranarayanan, C.	F. M., A. R. S., Koilpatti,	A. D., Tiruchengode
Mr. Syed Mohammad, D. A.	(On leave),	A. D., Gingee
Sri Sundaram, N. V.	Coconut Nursery Assistant, Palur,	Assistant in Mycology, Coimbatore
,, Sanjiva Shetty, K.	P. A., to D. A. O., Coimbatore,	A. D., Mangalore
Mr. Syed Sheriff,	A. D. C., M. P., Project area, Tanjore,	A. D., Mudukulathur
Sri Subramania Chetty, M.	Special A. D., Sugarcane Scheme, Karur,	F. M., A. R. S., Koilpatti
,, Satyanarayana Rao, G.	P. A., to D. A. O., Madras,	A. D., Palmaner
,, Sheik Hussain Sahib,	P. A., to D. A. O., Nellore,	A. D., Nellore
,, Subramanian, T. R.	F. M., C. B. S., Coimbatore,	Assistant in Entomology, Coimbatore
,, Sitarama Raju, D.	Assistant in Botany (on leave),	Assistant in Botany, Bapatla
,, Sithalinga Reddy, S.	A. D., Punganur,	Assistant in Mycology, Coimbatore
,, Sundaresan, K. R.	Special A. D., Sendarampatti,	A. D., Tirukoilur
,, Thomas, M.	A. D., Puthur,	A. D., Orthanad
,, Thomas, K. C.	On leave,	P. A., to D. A. O., Coimbatore
,, Varadarajan, S.	(On leave),	Assistant in Chemistry, Coimbatore
,, Veerabhadra Rao, K.	D. A. O., Nellore,	P. A., to D. A. O., Nellore
,, Venkataraghava Raju, N.	A. D., Ananthapur,	A. D., Attur
,, Vaidyanathan, J.	A. D., Papanasam,	Special A. D., Sendrampatti

CONTENTS.

TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high — and the Editorial Board will feel obliged if your articles are brief.

The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI February 1949 No. 2

Editorial

Industrial Crops: It is a truism that a person afflicted with a malady can think of nothing else and in this morbid state of mind falls a prey to the advice of any one who professes to know a speedy and sure cure rather than listen to his family physician. Unfortunately, India is in such a state to-day in regard to the food crisis and lends her ears too easily to the innumerable suggestions, plans and programmes which promise to usher an era of plenty and prosperity without reference to their practicability or advisability. Among the proposals which in our opinion is fraught with grave danger to the future balanced economy of the nation is the proposal emanating from certain quarters that the area under the so-called industrial crops should be restricted, by legislative enactments. We are afraid that in the panic caused by the dislocation of our food supply, we are apt to lose our sense of values and allow enthusiasts for special causes to hold the field. We submit that the cultivator himself and also the group of persons employed by the state to offer advice on agricultural matters, namely the organised agricultural departments in the various Provinces, have a right to be heard on the matter.

Now, let us consider dispassionately what would happen if the proposals to restrict the production of cotton, sugarcane or groundnut, is restricted by a ukase of the Government without taking into consideration the needs of the nation in respect of these commodities, and the area so released is put under food crops. The prices of cloth and sugar in the first instance will rise and foreign countries will dictate their own terms for supplying our needs. As we write, we hear the textile interests protesting that the price of cotton imported from outside, is

beyond their capacity to bear. The history of a recent transaction in jute, is another pointer indicating what lies ahead. Our industries which depend on these commodities will be thrown out of gear and industrial labour already troublesome will grow restless and communism will find a fertile field for spreading discontent and create chaos. Nor is this all. The cultivator baulked at every attempt to increase his wealth will sink into apathy and lacking incentive, will slacken his efforts even with regard to food production.

It should be realised that ultimately the nation as a whole has to foot the bill, whether it is for food or clothing and in a world organised on a monetary economy, as it is at present, the nation with less money at its disposal will ultimately come to grief.

Apart from the undesirable economic repercussions, which we forsee if the policy of undue restriction on the production of industrial crops is restored to, let us consider the agricultural aspect of the problem. Except in the deltaic tracts as in the Tanjore district, where owing to lack of drainage only paddy could be grown with profit and certain areas in the West Coast where growing of crops other than paddy is precluded by seasonal and soil conditions, the bulk of cultivatable land in other parts of the province both in the rainfed and irrigated tracts are suited to the growing of a variety of crops. In these areas cropping practices have been adjusted by the cultivators to ensure conservation of soil fertility, the prevention and multiplication of pests and diseases and avoidance of soil sickness. The seasonal rainfail is also utilised to a maximum extent. Mixed and rotational cropping in which surface rooted cereals are grown along with or in rotation with deep rooted crops like cotton are in vogue in the entire dry land area of the province. The introduction of the groundnut has given the cultivator a handy crop which can be grown with profit in many places during seasons when other crops will not do so well. The cultivator has by long experience learnt to grow just the crops that will give him maximum returns in his land in relation to seasonal factors, such as for example the date of receipt of the first rain and it will be risky indeed to restrict his choice.

We are of opinion therefore that centralised direction in such matters is attendant with grave risks, and crop planning and regulation from above without reference to local conditions will not only be difficult to carry out in practice, but also even if practicable, would fail to achieve the desired results.

This is not to say that state interference in all cases is undesirable. It goes without saying that the growing of narcotics like opium and ganja should be absolutely prohibited. The tendency in the Northern Circars to encroach on wetlands for the growing of virginian tobacco is to be curbed. The practice of growing tobacco continuously in the Guntur area without resulting to rotation should be put an end to. But barring these exceptional cases which should be dealt with according to the merits, it is our considered opinion that the cultivator should be free to grow the crops which will bring him the most profitable returns. In order to make him grow food crops which is of utmost necessity to-day, he should be offered sufficient inducement (1) by price adjustment narrowing the wide disparity between the prices of food grains on the one hand and industrial raw products on the other (2) by taking away the excess profits from industrial crops by judicious graded taxation (3) by extending the irrigation systems, and providing land in which food crops can be raised with profit.

There are signs that slump is round the corner and when it comes it is the cultivator who will be hardest hit, and in any planning for agricultural production this aspect should not be lost sight of.

Economics of Fruit Preservation as a Cottage Industry

By

Dr. G. S. SIDDAPPA, M.A., Ph.D., A R.I.C.,

(Biochemist)

Although the fruit and vegetable preservation industry is a large one which has been highly standardized, large quantities of surplus fruits and vegetables are preserved in numerous homes and small concerns all the world over. Large commercial concerns which make use of costly machinery and equipment which are often fully automatic with labour-saving devices, pack standard and uniform products for use at home and for the export trade. England, Australia, the U. S. A. and South Africa have built up a large export trade in preserved fruit and vegetables. Numerous homes in these countries, however, preserve their own fruits and vegetables during seasons of plenty. Suitable small-scale equipment by way of can sealers, jam boiling pans, pressure cookers, etc., have been specially designed for this purpose. By propaganda and demonstration, home preservation of fruits has become a safe process in the hands of the average housewife in those countries. In India, however, a beginning has yet to be made in this direction. In the meanwhile, small co-operative concerns and the larger orchards can profitably take up the preservation of fruits on a cottage industry scale. The production of highly standardized products in large well-equipped preservation factories employing automatic machinery and strict technical control should be the ultimate aim.

In the Government Fruit Products Research Laboratory at Kodur, a considerable amount of work has already been done on the preservation of a large number of different kinds of fruits. The methods have been standardized for the preservation of products like canned mangoes, pine-apples, guavas, grape-fruit etc., fruit juices and squashes like lime, lemon and orange squashes, mango and pineapple squashes, watermelon squash, passion fruit squash, cashewapple syrup, tomato juice etc. Different kinds of jams, jellies and marmalades like mango jam, pineapple jam, jack jam, wood-apple jam, banana jam, plum jam, guava jelly, orange marmalade, guava cheese, etc., have all been prepared. Other products like candied rumquat, jack, pineapple, ginger, orange peel and banana fig., banana flour, orange oil, etc , for which methods have been worked out are also of considerable interest. It is thus possible to prepare a large number of useful preserved products from South Indian fruits. In these days of balanced diet, fruits and vegetables with their valuable minerals and

vitamins are almost indispensable. They are important protective foods. Unfortunately, they are highly seasonal and much of the crop is wasted or spoilt during periods of glut. This is a serious loss to the country. Modern science has advanced greatly and it is now possible to preserve fruits and vegetables in all their freshness and richness so that they can be made available throughout the year. At present preserved fruits and vegetables are considered as luxury foods on account of their high cost. When the industry is well organised, it will be possible to bring them within the reach of the common man. The fruit and vegetable preservation industry is an industry of great national and economic importance and its development on a large factory as well as small home-scale should be the concern of the State.

Capital Investment: Very little equipment is required for the preservation of fruits on a small scale. Many of the items are generally available in the average home. Items like can-sealers, thermometers, hydrometers, glass jars, etc., can be purchased easily. A list of items of equipment which are useful for preparing a variety of fruit products is given in Table I. One will be surprised to learn that with this equipment as many as 100–150 cans of fruit, 100–150 bottles of fruit squash and 50–60 lbs. of jam per day can be turn out without any great exertion. The costliest item will be the preparation room and this cannot be avoided. The room should be fly-proof with wire gauze doors and windows. The walls and floor should be smooth and washable. There should be a good drain. A room 20 ft. x 20 ft. will be sufficient for the preservation room. Raw materials and finished products can be conveniently stored in a separate room.

Cost of Production: A large number of preserved products have been prepared at the Government Fruit Products Research Laboratory using equipment similar to that listed. The cost of production has been worked out. The overhead and supervision charges are, however, tentative. A sum of Rs. 10–12 per day towards these will be ample for a small concern. The cost of sugar at nine annas per pound is rather high. The cost of glass containers, corks and cans is also high on account of the abnormal times. There is ample scope for reducing these considerably in normal times. The tentative cost of production of a few typical products is given in the following paragraphs. Actual working data is also given. The costs are on the high side and will be much less when production is regular and to capacity.

The working capital for raw materials, containers, etc., may be taken on the average at about one rupee per can or bottle.

Establishment: The person in charge of the work should have undergone training in fruit canning and preservation at the Government Fruit Products, Research Laboratory. He should have a skilled labourer to assist him in the day-to-day work.

TABLE I.

Equipment for a small fruit preservation unit.

S. No.	Particulars	Number required	Cost Rs.	A.	P.
1	Aluminium basins with lids—capacity 20—100 lb. diameter 10"—20" ...	12	250	0	0
2	Saucepans 3—6 lb. capacity ...	4	10	0	0
3	Mugs ...	4	4	0	0
4	Strainers ...	2	6	0	0
5	Trays ...	2	12	0	0
6	Galvanised steel buckets ...	6	30	0	0
7	Kerosene stoves with 3—4 burners ...	2	75	0	0
8	Charcoal ovens with stand ...	4	16	0	0
9	Sieve for pulping ...	2	8	0	0
10	Spoons, large ...	2	3	0	0
11	Spoons, table ...	6 }	16	0	0
12	Spoons, tea ...	6 }			
13	Knives, stainless steel ...	6	18	0	0
14	China plates of different sizes ...	6	8	0	0
15	Glass tumblers ...	6	2	0	0
16	Orange squeezer ...	1	30	0	0
17	Wooden lime squeezer ...	12	25	0	0
18	Wooden basket press ...	1	160	0	0
19	Spring balance ...	1	30	0	0
20	Goldsmith's scales for weighing preservatives, with weights ...	1	25	0	0
21	Glass funnel 4"—6" diameter ...	2	2	0	0
22	Thermometer 0—240°F. ...	2	20	0	0
23	Brix hydrometer with jar (0—10, 10—20, 20—30, 30—60 and 60—90) ...	1 set	100	0	0
24	Rubber gloves ...	2 pairs.	5	0	0
25	Beakers 100—250 cc. ...	6	4	0	0
26	Perforated skimmer ...	2	2	0	0
27	Can sealer. Dixie automatic ...	1	150	0	0
28	Burpee canning Retort ...	1	150	0	0
29	Coring knives ...	6	15	0	0
30	Pineapple eye extractors ...	3	6	0	0
31	Can opener ...	1	1	0	0
32	Bottle opener ...	2	1	0	0
33	Stone jars. 25—50 lbs. ...	12	50	0	0
34	Glass carboys 5—6 gallon capacity ...	12	150	0	0
35	Cream squezee ...	2	12	0	0
36	Pestle and mortar, porcelain ...	1	4	0	0
37	Bottle cleaning brushes ...	12	2	0	0
38	Crown corking machine ...	1	90	0	0
39	Home dryer ...	1	100	0	0
40	Work tables ...	3	100	0	0
	Total ...		1,692	0	0

I. CANNED PRODUCTS.

		Rs.	A.	P.
(1) *Canned Mangoes* (i) *Neelum.* (in 40 deg. Brix Syrup)				
1. Neelum mangoes, 75 @ Rs. 5 per 100	...	3	12	0
2. Sugar—3 lb. 7 oz. @ 9 annas per lb.	...	1	14	8
3. Charcoal—¾ basket at Re. 1 per basket	...	0	12	0
4. Labour—¾ man-day at Re. 1 per day	...	0	12	0
Cost of 11 A 2½ cans prepared	...	7	2	8
Hence cost of contents per A 2½ can	...	0	10	5
Add (1) cost of can	...	0	4	0
(2) overhead charges	...	0	2	0
Hence cost of one A 2½ can of Neelum mangoes	...	1	0	5
Present sale price	...	1	8	0
(2) *Bangalora* (in 40 deg. Brix Syrup).				
1. Bangalora mangoes, 22 lb. @ 0—0—9 per lb.	...	1	0	6
2. Sugar—2 lb. 10 oz. @ 9 annas per lb.	...	1	7	8
3. Charcoal ¾ basket @ Re. 1 per basket	...	0	12	0
4. Labour ¾ man-day	...	0	12	0
Cost of 10 A 2½ cans prepared	...	4	0	2
Hence, cost of contents of one A 2½ can	...	0	6	5
Add (1) cost of can	...	0	4	0
(2) overhead charges	...	0	2	0
Hence, cost of one A 2½ can of Bangalora mangoes	...	0	12	5
(3) *Canned guavas* (in 45 deg. Brix Syrup).				
1. Guavas — 13 lb. — 13 oz. at one anna per lb.	...	0	14	0
2. Sugar — 3 lb. 8 oz. at 9 annas per lb.	...	1	15	6
3. Charcoal — 1 basket @ Re. 1 per basket	...	1	0	0
4. Labour — 1 man-day	...	1	0	0
Cost of 17 A-1 small cans	...	4	13	6
Hence, cost of contents of one A-1, can	...	0	4	7
Add (1) cost of can	...	0	2	0
(2) overhead charges	...	0	1	0
Hence, cost of one A-1 can of guavas	...	0	7	7

Note.—A-1 can is only about half the size of A 2½ can.

(4) *Canned Grapefruit* (in 60 deg Brix Syrup)				
1. Grapefruits 4 (4 lb.) @ 8 pies per lb.	...	0	2	8
2. Sugar 1 lb. @ 9 annas per lb.	...	0	9	0
3. Caustic soda for lye peeling 2/3 oz. at 5 annas an ounce	...	0	3	4
4. Charcoal ¼ basket @ Re. 1 per basket	...	0	4	0
5. Labour ¼ man-day	...	0	4	0
Total cost of contents of 2-A 2½ cans	...	1	7	0

		Rs.	A.	P.
Hence, cost of contents of one A 2½ can	...	0	11	6
Add (1) cost of can	...	0	4	0
(2) overhead charges	...	0	2	0
Hence, cost of one A 2½ can of grape fruit	...	1	1	6

Note :— The cost of production of canned chinee orange, loose-jacket orange pummelo, etc., will be about the same.

II. JUICES, SQUASHES AND CORDIALS

(1) *Mango squash* (45 deg. Brix)

1. Country juicy mangoes—200 at Rs. 3 per 100	...	6	0	0
2. Lime juice—7⅞ lb. (250 limes) at Re. 1 per 100	...	2	8	0
3. Sugar 28 lb. 7 oz. @ 9 annas per lb.	...	16	0	0
4. Preservative, pottassium meta bi-sulphite 20 gm. @ 0—3—6 per oz.	...	0	2	6
5. Charcoal, 2 baskets at Re. 1 per basket	...	2	0	0
6. Labour—1 man-day	...	1	0	0
Total cost of 35 bottles of squash. 24 oz. each	...	27	10	6
Hence, cost of contents per bottle	...	0	12	8
Add (1) cost of bottle	...	0	6	0
(2) cost of crown cork	...	0	0	3
(3) overhead charges	...	0	2	0
Hence, cost of one 24 oz. bottle of mango squash	...	1	4	11

(2) *Chinee orange squash (60 Deg. Brix)*

1. Kodur Chinee oranges, 433 @ Rs. 15 per 100	..	65	0	0
2. Limes 2,000 at Re. 1 per 100	...	20	0	0
3. Sugar 267 lb. 7 oz. @ 9 annas per lb.	...	150	7	0
4. Preservative, K. M. S., 5 oz. at Re. 0—3—6 per oz.	...	1	1	6
5. Charcoal, 10 baskets at Re. 1 per basket	...	10	0	0
6. Labour, 5 man-days	...	5	0	0
Total cost of contents of 230 bottles x 24 oz.	...	251	8	6
Hence, cost of contents of one bottle	...	1	1	6
Add (1) cost of bottle	...	0	6	0
(2) cost of cork	...	0	0	3
(3) over-head charges	...	0	2	0
Hence, cost of 1 x 24 oz. bottle of orange squash	...	1	9	9

Note:— The cost of fruit is nearly twice the normal price.

(3) *Loose-jacket orange squash* (60 Deg. Brix)

		Rs.	A.	P.
1.	Loose-jacket oranges (Coorg or Santra) 110 at Rs. 8 per 100 ...	8	12	0
2.	Limes 200 at Re. 1 per 100 ...	2	0	0
3.	Sugar 26 lb. 11 oz. at Re. 0—9—0 per lb. ...	15	0	0
4.	Preservative, K. M. S. ½ oz. Re. 0—3—6 per oz. ...	0	1	9
5.	Charcoal 1½ baskets @ Re. 1 per basket ...	1	8	0
6.	Labour 1 man-day ...	1	0	0
	Total cost of 25 x 24 oz. squash ...	28	5	9
	Hence, cost of contents of one bottle ...	1	2	2
	Add (1) cost of bottle ...	0	6	0
	(2) cost of cork ...	0	0	3
	(3) over-head charges ...	0	2	0
	Hence, cost of 1 x 24 oz. bottle of squash ...	1	10	5

(4) *Lime Squash* (50 deg. Brix)

		Rs.	A.	P.
1.	Limes 1,000 @ Re. 1 per 100 ...	10	0	0
2.	Sugar 49 lb.—6 oz. @ Re. 0—9—0 per lb. ...	27	12	4
3.	Preservative K. M. S. 1 oz. at Re. 0—3—6 per oz. ...	0	3	6
4.	Charcoal—2 baskets at Re. 1 per basket ...	2	0	0
5.	Labour 2 man-days ...	2	0	0
	Total cost of 56 x 24 oz. bottles of squash ...	41	15	10
	Hence, cost of contents of one bottle ...	0	12	0
	Add (1) cost of bottle and cork ...	0	6	3
	(2) over-head charges ...	0	2	0
	Hence, cost of 1 x 24 oz. bottle of lime squash ...	1	4	3

Note:— The cost of production is high due to the high cost of sugar.

(5) *Lemon Squash* (45 deg. Brix)

		Rs.	A.	P.
1.	Lemons 38 at Re. 1—0—8 per 100 ...	0	6	4
2.	Sugar 13 lb. 11 oz. @ Re. 0—9—0 per lb. ...	7	11	0
3.	Preservative, K. M. S. 9 grams @ Re. 0—3—6 per oz. ...	0	1	2
4.	Charcoal, 1 basket at Re. 1 per basket ...	1	0	0
5.	Labour 1 man-day ...	1	0	0
	Total cost of 17 x 24 oz. bottles of squash ...	10	2	6
	Hence, cost of contents of one bottle ...	0	9	7
	Add (1) cost of bottle and cork ...	0	6	3
	(2) over-head charges ...	0	2	0
	Hence, cost of 1 x 24 oz. bottle of lemon squash ...	1	1	10

		Rs.	A.	P.
(6) *Pineapple Squash* (50 deg. Brix)				
1. Pineapples, 12 @ Re. 0—8—0 each	...	6	0	0
2. Limes, 150 @ Re. 1 per 100	...	1	8	0
3. Sugar. 16 lb. 5 oz @ Re. 0—9—0 per lb.	...	9	3	0
4. Preservative, K. M. S. 10 grams at 0—3—6 per oz.	...	0	1	3
5. Charcoal 1 Basket @ Re. 1 per basket	...	1	0	0
6. Labour 1 man-day	...	1	0	0
Total cost of contents of 20 x 24 oz. bottles of squash	...	18	12	3
Hence, cost of contents of one bottle	...	0	15	0
Add (i) cost of bottle and cork	...	0	6	3
(ii) overhead charges	...	0	2	0
Hence, cost of 1 x 24 oz. bottle of pineapple squash	...	1	7	3
(7) *Water-melon Squash* (55 Deg. Brix.)				
1. Water-melons 6	...	2	8	0
2. Limes 250 @ Re. 1 per 100	...	2	8	0
3. Sugar 27 lb. 3 oz. @ Re. 0—9—0 per lb.	...	15	4	8
4. Preservative, sodium benzoate 23. 4 gr. @ Re. 0—14—6 per oz.	...	0	12	2
5. Charcoal 1 Basket	...	1	0	0
6. Labour 1 man-day	...	1	0	0
Total cost of contents of 27 x 24 oz. bottles	...	23	0	10
Hence, cost of contents per bottle	...	0	13	8
Add (i) cost of bottle and cork	...	0	6	3
(ii) overhead charges	..	0	2	0
Hence, cost of 1 x 24 oz. bottle of watermelon Squash	...	1	5	11
(8) *Passion Fruit Squash* (55 Deg. Brix.)				
1. Passion fruit 14 lb. at Re. 0—4—0 per lb. plus freight	...	4	10	0
2. Sugar 6 lb. 5 oz. @ Re. 0—9—0 per lb.	...	3	9	0
3. Preservative, K. M. S. 3. 4. grams at 1. 5. pies per gram	...	0	0	5
4. Charcoal 1/4 basket at Re. 1 per basket	...	0	4	0
5. Labour 1/4 man-day	...	0	4	0
Total cost of contents of 6 x 24 oz. bottles	...	8	11	5
Hence, cost of contents of one bottle	...	1	7	3
Add (i) cost of bottle and cork	...	0	6	3
(ii) overhead charges	...	0	2	0
		1	15	6

Note :— The cost of fruit and sugar is very high.

		Rs.	A.	P.
(9) *Cashew-apple Syrup* (60 deg. Brix).				
1. Cashew-apple, 750 @ Re. 0—0—3 per 10 fruits	...	1	2	9
2. Limes 215 @ Re. 1 per 100	..	2	2	5
3. Sugar 27 lb. 10 oz. @ Re. 0—9—0 per lb.	...	15	9	0
4. Preservative, K. M. S. 23.5 gram @ Re. 0—3—6 per oz.	...	0	3	0
5. Charcoal 1 basket	...	1	0	0
6. Labour 1 man-day	...	1	0	0
Total cost of contents of 24 x 24 oz. bottles	...	21	1	2
Hence, cost of contents per bottle	...	0	14	1
Add (i) cost of bottle and cork	...	0	6	3
(ii) overhead charges	...	0	2	0
Hence, cost of 1 x 24 oz. bottle of cashew-apple syrup	...	1	6	4
(10) *Fruit cocktail*				
1. Chinee orange squash 4 x 24 oz. bottles at 1—9—9 each	...	6	7	0
2. Pineapple squash 4 x 24 oz. bottles at 1—7—3 each	...	5	13	0
3. Tomato juice 2 x 24 oz. bottles at 1—1—1 each	...	2	2	2
Total cost of 10 x 24 oz. bottles of Fruit cocktail	...	14	6	2
Hence, cost of 1 x 24 oz. bottle	...	1	7	0
(11) *Tomato juice*				
1. Tomatoes 24 lb. at Re. 0—8—0 per 3 lb.	...	4	0	0
2. Common salt 2½ oz.	...	0	0	1
3. Charcoal 1 basket	...	1	0	0
4. Labour ½ man-day	...	0	8	0
Total cost of contents of 10 x 24 oz. bottle	...	5	8	1
Hence, cost of contents per bottle	...	0	8	10
Add (i) cost of bottle and cork	...	0	6	3
(ii) overhead charges	...	0	2	0
Hence, cost of one 24 oz. bottle of tomato juice	...	1	1	1

Note:— The cost of tomatoes is very high.

III. JAMS, JELLIES AND MARMALADES.

		Rs.	A.	P.
(1) *Mango Jam.* (Bangalora)				
1. Mangoes, Bangalora, 74 fruits weighing 73¼ lb at Re. 0—0—9 per lb.	...	3	7	2
2. Sugar 35¼ lb. at Re. 0—9—0 lb.		19	13	3
3. Tartaric Acid, 6 2/3 oz. at Re. 0—3—6 per oz.	...	1	7	4
4. Charcoal 2 Baskets at Re. 1 per basket	...	2	0	0
5. Labour 2 man-days	...	2	0	0
Cost of 38 x A 2½ cans of jam (85 5/8 lb)	...	28	11	9

		Rs.	A.	P
Hence, cost of one lb.	...	0	5	4
Cost of one A 2½ can jam	...	0	12	1
Add (i) cost of can	...	0	4	0
(ii) overhead charges	...	0	2	0
Hence, cost of 1 A 2½ can mango jam	...	1	2	1

(2) *Mango Jam.* (Neelum)

		Rs.	A.	P
1. Mangoes, Neelum 133 at Rs. 5/- per 100	...	6	10	8
2. Sugar 16 lb. 8 oz. at Re. 0—9—0 per lb.	...	9	4	6
3. Tartaric acid, 87-4 grams at Re 0—3—6 per oz.	...	0	10	11
4. Charcoal 1¼ baskets at Re. 1 per basket	...	1	4	0
5. Labour 1 man-day	...	1	0	0
Cost of 417/16 lb. of jam (18 cans-A 2½ size)	...	18	14	1
Hence, cost of one lb. jam	...	0	7	3
Cost of contents of one A 2½ can	...	1	0	9
Add (i) cost of can	...	0	4	0
(ii) overhead charges	...	0	2	0
Hence, cost of one A 2½ can mango jam	...	1	6	9

(3) *Plum Jam*

		Rs.	A.	P
1. Plums — sour — 14 lb at Re. 0—5—0 per lb.	...	4	6	0
Freight from Coonoor	...	0	12	0
2. Sugar, 10 lb. @ Re. 0—9—0 per lb.	...	5	10	0
3. Charcoal, ¾ basket at Re. 1 per basket	...	0	12	0
4. Labour — 3/4 man-day	...	0	12	0
Total cost of 19½ lb. jam	...	12	4	0
Hence, cost of 1 lb. jam	...	0	10	1
Cost of jam in an A 2½ can (2½ lb.)	...	1	9	2
Add (i) cost of can	...	0	4	0
(ii) overhead charges	...	0	2	0
Hence, cost of an A 2½ can of plum jam	..	1	15	2

(4) *Pineapple Jam.*

		Rs.	A.	P
1. Pineapples 4 at Re. 0—8—0 each	...	2	0	0
2. Sugar 3 lb. 11 oz @ Re. 0—9—0 per lb.	...	2	1	2
3. Limes 5 @ 2 pies each	...	0	0	10
4. Charcoal ½ basket at Re. 1 per basket	...	0	8	0
5. Labour 1/3 man-day at Re. 1 per day	...	0	5	4
Total cost of 5½ lb. jam	...	4	15	4
Cost of 1 lb. jam	...	0	14	5

		Rs.	A.	P.
Cost of 2½ lb. jam (1 A 2½ can)	...	2	4	1
Add (i) cost of can	...	0	4	0
(ii) head charges	...	0	2	0
Hence, cost of an A 2½ can of pineapple jam.	...	2	10	1

Note:— The cost is very high on account of the high cost of fruit.

(5) *Jak Jam*

1. Jak fruit. 2 @ Rs. 1—8—0 each	...	3	0	0
2. Sugar 9 lb @ Re. 0—9—0 per lb.	...	5	1	0
3. Tartaric acid 48 gr. @ Re. 0—3—6 per oz.	...	0	6	0
4. Charcoal, 1 basket	...	1	0	0
5. Labour 1 man-day	...	1	0	0
Total cost of 17 lb. jam	...	10	7	0
Hence, cost of 1 lb. jam	...	0	9	10
Cost of 2½ lb. jam (A 2½ can)	...	1	8	7
Add (i) cost of can	...	0	4	0
(ii) overhead charges	...	0	2	0
Hence, cost of an A 2½ can of jak jam	...	1	14	7

(6) *Banana Jam.*

1. Bananas, 61 @ Rs. 2—2—0 per 100	...	1	4	8
2. Sugar 7¼ lb. Re. 0—9—0 per lb.	...	4	1	3
3. Tartaric acid, 38 gram @ Rs. 0—3—6 per oz.	...	0	4	9
4. Charcoal ½ basket at Re. 1 per basket	...	0	8	0
5. Labour ½ man-day	...	0	8	0
Cost of 5 x A 2½ cans (13 3/8 lb. jam)	...	6	10	8
Cost of 1 lb. of jam	...	0	8	0
Cost of jam in an A 2½ can	...	1	5	4
Add (i) cost of can	...	0	4	0
(ii) overhead charges	...	0	2	0
Hence, cost of an A 2½ can of banana jam	...	1	11	4

(7) *Custard apple Jam.*

1. Custard apples, 54 @ Rs. 5/- per 100	...	2	11	2
2. Sugar, 3 ib. 3 oz. @ Re. 0—9—0 per lb.	...	1	12	7
3. Tartaric acid, 17 gram @ Re. 0—3—6 per oz.	...	0	2	2
4. Charcoal, 1/8 Basket @ Re. 1 per basket	...	0	2	0
5. Labour 1/8 man-day at Re. 1 per day	...	0	2	0
6. Cost of 5 lb. 5 oz. jam	...	4	13	11

		Rs.	A.	P.
Hence, cost of 1 lb. jam	...	0	14	8
Cost of 2½ lb. jam (1 x A 2½ can)	...	2	4	8
Add. (i) cost of can	...	0	4	0
(ii) overhead charges	...	0	2	0
Hence, cost of an A 2½ can of custard apple jam	...	2	10	8

Note:— The cost is high since the yield of jam is low due to losses in handling small experimental lots.

(8) *Woodapple Jam.*

		Rs.	A.	P.
1. Woodapples, 9 at 0—0—6 each	...	0	4	6
2. Sugar, 1 lb. 8 oz. @ Re. 0—9—0 per lb.	...	0	13	6
3. Tartaric acid, 6·4 gram at Re. 0—3—6 per oz.	...	0	0	10
4. Charcoal 1/8 basket at Re. 1 per basket	...	0	2	0
5. Labour 1/8 man-day at Re. 1 per day	...	2	0	0
Cost 3 3/16 lb. of jam.	...	1	6	10
Hence, cost of 1 lb. jam	...	0	7	2
Cost of 2½ lb. jam (1 x A 2½ can)	...	1	1	5
Add (i) cost of can	...	0	4	0
(ii) overhead charges	...	0	2	0
Hence, Cost of an A 2½ can of Woodapple jam	...	1	7	5

(9) *Guava Jelly.*

		Rs.	A.	P.
1. Guavas, 36 lb. 14 oz. at Re. 0—1—0 per lb.	...	2	5	0
2. Sugar 32 lb—6 oz. at Re. 0—9—0 per lb.	...	18	3	5
3. Tartaric acid,, 5 oz. at Re. 0—3—6 per oz.	...	1	1	6
4. Charcoal 2½ baskets at Re. 1 per basket	...	2	8	0
5. Labour 2½ man-days at Re. 1 per day	...	2	8	0
Cost of 46 3/8 lb. of jelly	...	26	9	11
Hence, cost of 1 lb. jelly	...	0	9	2
Cost of 2½ lb. jelly (1 x A 2½ can)	...	1	6	11
Add (i) cast of can	...	0	4	0
(ii) overhead charges	...	0	2	0
Hence, cost of an A 2½ can of guava jelly.	...	1	12	11

(10) *Orange marmalade*

		Rs.	A.	P.
1. Marmalade oranges, 115 at Re. 1 per 100	...	1	2	5
2. Sugar, 13 lb. 7 oz. at Re. 0—9—0 per lb.	...	7	9	0
3. Charcoal, 1¼ baskets at Re. 1 per basket	...	1	4	0
4. Labour, 1 man-day	...	1	0	0
Cost of 17½ lb. (7 A 2½ cans) of marmalade	...	10	15	5

	Rs.	A.	P.
Hence, cost of 1 lb. of marmalade ...	0	10	2
Cost of 1 x A 2½ can marmalade ...	1	9	1
Add (i) cost of can ...	0	4	0
(ii) overhead charges ...	0	2	0
Hence, cost of an A 2½ can of orange marmalade ...	1	15	1

IV. DRIED PRODUCTS.

(1) *Banana Figs*

1. Bananas (Pacha Arati, Local variety) 200 at Rs. 2 per 100	4	0	0
2. Sulphur ½ oz. at Re. 0—2—0 per oz. ...	0	1	0
3. Charcoal 2 baskets at Re. 1 per basket ...	2	0	0
4. Labour 1/4 man-day at Re. 1 per day ...	0	4	0
Cost of 6½ lb. of figs ...	6	5	0
Hence, cost of 1 lb. of banana figs, loose ...	0	15	6

(2) *Banana Flour*

1. Bananas (Bontha Arati variety) 75 at Rs. 1—8—0 per 100 ...	1	2	0
2. Charcoal, 1 basket at Re. 1 per basket ...	1	0	0
3. Labour, 1/4 man-day at Re. 1 per day ...	0	4	0
Cost of 2½ lb. flour ...	2	6	0
Hence, cost of 1 lb. of banana flour (loose) ...	0	15	3

V. CANDIED PRODUCTS.

(1) *Ginger Candy*

1. Ginger 7 lb. at Re. 0—7—0 per lb. ...	3	1	0
2. Sugar, 4 lb. at Re. 0—9—0 per lb. ...	2	4	0
3. Charcoal, ½ basket at Re. 1 per basket ...	0	8	0
4. Labour ½ man-day ...	0	8	0
Cost of 3 lb. candy ...	6	5	0
Hence, cost of 8 lb. ginger candy loose ...	2	1	8

(2) *Citrus peel candy*

1. Sugar, 4 lb. at Re. 0—9—0 per lb. ...	2	4	0
2. Common salt, 1 lb. 13 oz. at 0—0—9 per lb. ...	0	1	3
3. Charcoal, 1/3 basket at Re. 1 per basket ...	0	5	4
4. Labour, 1/4 man-day ...	0	4	0
Cost of 3 lb. candy ...	2	14	7
Hence, cost of 1 lb. citrus peel candy (loose) ...	0	15	6

(3) *Jak candy*

		Rs.	A.	P.
1. Jak fruit one at Re. 0—12—0	...	0	12	0
2. Sugar, 3 lb. at Re. 0—9—0 per lb.	...	1	11	0
3 Charcoal, 1/3 basket at Re. 1 per basket	...	0	5	4
4. Labour 1/4 man-day at Re. 1 per day	...	0	4	0
Cost of 2 lb. candy	...	3	0	4
Hence, cost of 1 lb. of jak candy (loose)	...	1	8	2

Note:— The syrup can be bottled as "Jak syrup".

(4) *Kumquat candy*

1. Kumquats, 309 at Re. 0—2—0 per 100	...	0	6	2
2. Sugar, 9 lb. at Re. 0—9—0 per lb.	...	5	1	0
3. Charcoal, 1½ baskets at Re. 1 per basket	...	1	8	0
4. Labour 1 man-day	..	1	0	0
Cost of 7 lb. candy	...	7	15	2
Hence, cost of 1 lb. kumquat candy (loose)	...	1	2	2

Note:— The candying processes are spread over 8—10 days, but they can be carried out by persons engaged for the preparation of other products.

VI. PICKLES AND CHUTNEYS.

(1) *Sweet Mnago Chutney*

1. Mangoes — Bangalore, 30 fruits (25½ lb.) at Rs. 7—8—0 per 100		2	4	0
2. Sugar, 14 lb. at Re. 0—9—0 per lb.	...	7	14	0
3. Common salt, 14½ oz. at Re. 0—0—9 per lb.	...	0	0	8
4. *Spices, onion, chillies and ginger	...	1	11	0
5. Vinegar, 3⅜ lb. at Re. 0—12—0 per lb.	...	2	11	6
6. Charcoal 1¼ baskets at Re. 1 per basket	...	1	4	0
7. Labour 1 man-day	...	1	0	0
Cost of 24 3/8 lb. chutney	...	16	13	2
Hence, cost of 1 lb. sweet mango chutney, loose	...	0	11	1

Note:— The chutney may be packed in 1 lb. glass jars with bakelite caps. It is a very good product.

* *Spices, etc., used.*

		Rs.	A.	P.
Cloves	6 tolas	0	4	0
Cinnamon	6 tolas	0	4	0
Cardamom	3 tolas	0	3	0
Mace	3 tolas	0	3	0
Aniseed	6 tolas	0	4	0
Cumin	6 tolas	0	2	0
Red Chillies	12 tolas	0	2	0
Onions	1½ lb.	0	3	0
Ginger	6 tolas	0	2	0
	Total	1	11	0

*An Organisation to Check the Present Food Crisis in India

By

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AGENCIES THAT LED TO THE PRESENT CRISIS

(i) *Lessons of Agricultural Crisis in Retrospect.* In planning to end the crisis, a dive into the past agricultural crises will throw a flood of light to get over the present one. A crisis followed always a war of the first magnitude. The first in modern times was after the Napoleonic wars; the next, after World War I. A period of scarcity of food stuffs each time was followed by a slump and falling prices. An Agricultural Depression prevailed in Europe from 1824 to 1835; it recurred in 1875 and ended by 1905. Improvement in communications and the rise in the price of gold helped the recovery. According to the Economic committee of the League of Nations, "in 1909—13, cereal prices were 20% higher than the average level of the years 1891—1900". The Depression from 1929 to 1939 had its trough in 1934. To this Depression were ascribed the causes, of over production by various countries to supply food to the belligerents during the war and the technical progress in the U. S. A., by a heavy increase in the number of tractors and better farm equipment. In the trough of the Depression, these very farm-steads became bankrupt and the U. S. A. had to liquidate and possess them. The scorched-earth policy of World War II and the non-recovery from it effects by now of several countries and the the control and manipulation of currencies under dollar pools and sterling pools are responsible for the present scarcity of food. Statisticians, with periodicity curves in several branches of Agriculture and Industry, mention of an intensive coalescing Depression between 1951 and 1953. Were scarcity and slump to follow in close sequence as in the past, planning both short-term and long-range, to tide over the present crisis should be done with extreme care.

(ii) *Present Food Crisis — Remote and Immediate Causes.*

A. Remote Causes.

1. *Unbalanced agricultural economy and craving for more industrial goods.* With improvement in the standard of living, the comfort

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and luxuries of a past age become the necessaries of a subsequent age. The Administration operating the controls listed out as essential articles, a certain number of the consumers' requirements. How many of them were essential in Asoka's reign? In the reign of Prithvi Raj? Of Krishna Deva Raya? Of Sivaji? And at the present time? Would the present population agree to a pristine set up? Can the Administration arrange to educate the population, to have for their vocation, the production of food and cloth and deter them from the production of cash crops and manufacturing industries The proportion in the pursuits of Agriculture and Industry have to be defined by the State to tide over the Crisis.

2. *Country bound by Western economy.* India for nearly two centuries has been fitted into Western economy. Currency, banking, exchange, export trade in raw products and import trade in manufactured goods are all interlinked. To escape the grip of these economic tentacles and have a sound food policy, India's agriculture must be bounty-fed.

B Immediate Causes

While such had been the remote causes, the immediate causes of the present food crisis have all their roots in the last Economic Depression.

Manure starved land in falling prices Cattle manure and the house-hold and farmyard sweeping are supplemented in any year, with other purchased manures with the rise in prices. These purchases were curtailed with the fall in prices and were next to nothing in the trough of the Economic Depression, when the value of the produce did not meet even production costs. Several cultivators in 1934 had to pawn jewels and pay taxes. The investment on the manure was in the decline; and when the Second World War broke out, the fertility of the soil was nothing more than that of the recuperating nitrates of the summer weathering, plus the available cattle manure, sweepings and offal from the holding. This was a great contributory cause for decreasing production, in the earlier years of the war.

2. *Best paddy land is diverted to non-food crops.* Production did not keep pace in spite of the make-up, or increase in area from marginal land, newly put under it.

3 *Political repercussions on indigenous paddy production* When the country took to hand spinning and paralysed the Lancashire Textile Industry, Lancashire products were diverted to Netherland Indies, Siam etc., which paid for them, by

importing, broken rice into Madras, at Rs. 3/- to Rs 5/- (from 1931 onwards), per bag of 166 lb., with subsequent monetary adjustments between India and the United Kingdom. This was a factor beyond the limits of the Provincial Government and the Agricultural departments. This low priced import from the Far East and from Burma to the tune of fourteen million tons of rice annually, struck the local rice cultivator at the very root of his economics. The Government wanted the Agricultural department, at the time, to suggest alternative cropping, to enable the ryot to balance the expenditure on his holding and pay taxes by raising more renumerative crops. Paddy was discouraged and garden crops suggested till World War II. Food for the first time had come under Politics. There could be an International Wheat Agreement and not Rice Agreement.

Present pessimism on production and yields cannot be helped when price controls and subsidies to essential commodities are inadequate. The local rice cultivator stood unrecognised so long as the imports of paddy from the Far East and Burma were annually received. He could not then be helped with better prices or with subsidies. Even now price levels are maintained by the Central Government, the local Governments being only recommendatory bodies for price fixation.

5. *Transition of land from the cultivating small holder.* The small holder entirely dependent on Agriculture and with no subsidiary occupation, under indebtedness had to alienate his holding to the capitalist, the money-lender, or the landed-proprietor. To the first two classes, farming was a commercial proposition; to the third, all land beyond his capacity for cultivation was also a commercial proposition under falling or less attractive prices. Personal interest in land was thus lost in large regions in this transition.

6. *Lack of progress in the production of the old Deltas.* The old deltaic lands are fairly stabilised in their physical condition. The results of crop cutting experiments have shown, during the past three years in the Godavary Districts that paddy transplanted early i. e, prior to 15th July, yields higher than all subsequent plantings, as sub-joined results show.

The optima of water requirements at the planting, flowering and seed-setting stages are not met by more than a third of the paddy ayacut. As the earlier planted crops have 150-200% yields of the late planted, the construction of reservoirs and regulators high up on the rivers of these old deltas, would double production from existing deltas, in addition to crops on fresh ayacuts that spring up.

Disrict	Time of planting	Percentage proportion in area. 1945-46	1946-47	1947-48	Yield in lb. per acre 1945-46	1946-47	1947-48
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I. East Goda-vary.	Early (before 15th July.	34	33	28	1432*	1739	2397
	Middle (16th July to 15th Aug,	52	50	62	1798	1279	1985
	Late (after 15th Aug.)	14	17	10	1169	623	1069
II. West Goda-vary.	Early (before 15th July)	37	63	36	1462	1878	1944
	Middle (16th July to 15th Aug.)	46	51	54	1345	1215	1636
	Late (after 15th Aug.)	17	6	10	1159	1529**	1251

* Grain blown off these crops which matured in the severe cyclone of October 1945

** Late varieties in Kollair lake ayacut had a good season

WAY TO END THE CRISIS.

I. Long-Term Policy.

1. *Large irrigation projects, the chief panacea — The G. M. F. Schemes collectively are no match to a helping season.* A summary of measures taken and concessions given by the Government is published, in a pamphlet under the title 'Grow More Food'. It will be expected from the grants made by the Central Government and Provincial Government and expended by the departments of Revenue, Agriculture, P. W. D., Co-operation, Industries etc., that more food is added year after year. It will be surprising to note that the production figures as given in some of the Season and Crop Reports are much higher for the early-war years than the late war or post-war years. The seasons of some of the early war-years were much better in enabling timely sowings and plantings, and in assisting to put crops in greater ayacuts under the same sources of irrigation than in the late-war or post-war years. It is not a loan or a bonus,

good seed or more manure, the remodelling of a channel or an ayacut, or measures of the kind that can end the crisis. Gigantic projects for irrigation coupled with flood control and hydro-electricity development can alone mend and end the present and future crises. By such planning, production can be increased to 200% by regulated water supply enabling timely planting etc., in the existing ayacuts; double crops can be raised in them; and fresh ayacuts developed for new production.

Drainage schemes follow as a natural corollary to all irrigation projects. Their need in the old deltas is manifest.

2. *Planning between Agriculture and Industry.* The value of agriculture, for promoting material prosperity beyond a stage is limited. The industrial world by bringing into existence fresh industries is absorbing much of the capital and skilled labour to the detriment of agricultural progress and development. Sri M. Visveswaraya, proposed to reduce the population supported by agriculture from 250 million to 200 million, in a ten-year plan. Organised planning between agriculture and industry should put a stop to diversion of pursuit from one to the other, without recourse to ordinances as in the present case of agricultural labour in the Central Provinces moving into "beedi" manufacture.

3. *Barter through failure of Western Economy.* Industrial supremacy, maritime commerce, liberation of specie from mining give power to control currencies and manipulate exchanges India in its non-age in these respects, avoids western economy and resorts to the barter under bilateral agreements which she now pursues. Wheat from Russia and Australia, rice from Burma and the Far East, maize from Argentina, heavy machinery from Czechoslovakia, capital goods from Britain, automobiles from America are present examples. Planning is necessary to balance the trade and cut out imports of food beyond a limit.

4. *Minor engineering against scouring and soil erosion.* A permanent Soil Conservation department may be established. Part of the cess-funds for researches on crops may be diverted to the execution of projects under soil erosion.

5. *Constitution of economic holdings.* Agricultural progress was by rapid strides in other countries, with the constitution of economic holdings.

In Denmark, the present farms were exempted from the inheritance by each child of a family. In England the law of Entail concentrated the land in a few hands. In Sweeden, the State took the initiative and enforced that each peasant's land should be a single piece. In Austria, the economic holding has been recognised by law, with hereditary indivisibility and alienation from debts not extinguishable in a few years. In Italy, comprehensive measures have been taken to induce the people to form economic holdings. Legislation in India, for the purpose, should be such as to make small holdings coalesce and big holdings dwindle down into the economic unit of the region. Uneconomic small bits of holdings, may be purchased by the State and offered for sale to coalesce with the holdings of adjoining owner-cultivators.

II. Short-Term Policy by the Departments.

1. *Merger of food organisation in the Firka Development Scheme.* The All India Manufacturers' Association, under the leadership of Sri M. Visveswaraya, have a 'Village Industrialisation Scheme', for the 700,000 villages of the country, by grouping them into numbers ranging from 10 to 15. The province of Madras has the Firka Development Scheme and into this, the food organisation may be merged. A suitable committee from the firka is to be responsible for the productian and distribution to meet the needs of the firka.

With a choice left to the ryot, to put more area or less area, good or bad land under food or non-food crops, based on prevailing prices, production cannot organise itself to the tune of requirement. The firka committee with the help of the village officers, a year in advance, may work out the food needs of the families in the firka, make it incumbent on the holders of land to grow their food first, before they think of non-food crops. The deficits in requirement as well as the surpluses will be intimated to a taluq organisation which will effect the necessary transfers. The district organisation will deal with inter-district transfers under advice of a Provincial Organisation.

2. *Grain Banks.* It was a policy of the Japanese Government to store rice to last two or three years, to prevent starvation in emergency. The construction of M. B. sheds may be extended to each village. To pool stocks of grains, grain banks may be instituted. This may be part of the firka development work referred to previously. As the owner-cultivators comprise 15% and the cultivating tenants 5% of the population, the former body may be suitably induced to cede

their food-grains over their requirements to the Bank. If the village is not self-sufficient in its needs of food, a Collective farm may be run to meet the village needs.

3. *A directory of agricultural improvements based on the Settlement Classification of Soils.* There are economic surveys of several districts in the Provinces and States conducted during the last three decades More than these surveys, a directory of agricultural improvements with different crops of different kinds of soils is necessary. Though not endowed with a knowledge of the soil science and the requirements of crops, the Settlement Officers laboured hard for over 87 years to sort out and classify soils from their physical properties and from observations of crop stand, as alluvial, permanently improved, black-regar, red-regar, calcareous and arenaceous. The regars and the calcareous are further divided into clay, loam and sand and the arenaceous into loamy-sand and heavy-sand. Each of these sub-divisions are further detailed into 'best,' 'good', 'ordinary', 'inferior' and 'worst', from experience of crop growth and productivity. The District Agricultural Officer of a district may prepare a directory of improvements for each crop that can be raised on every minor division of the soil in the district, based on this settlement classification. The costs of cultivation of crops may be worked out for each of these minor divisions, as bullock-days, men-days, women-days and juvenile-days, for permanent reference, avoiding the changing labour rates.

4. *The Comprehensive Scheme must justify its title.* The targets of production for the districts and the taluqs must ultimately be extended to every survey number of the Permanent Register of the village. The elaborated staff under the scheme must be made to tackle each survey number, assess the margin of production that can be enhanced by applying to the field of the survey number, one and all of the improvements of the 'directory' herein-before mentioned. The District work Register of the Agricultural department is to be written for every survey number. To implement this direction, the Agricultural Demonstrator may be supplied with the Settlement Registers of the villages in his jurisdiction.

5. *The economic manuring of each field.* "In most parts of India, soil fertility is stabilised at comparatively low level". So concluded Dr. Burns, after an examination of the results of over 5,000 manurial experiments in India. The results of crop cutting experiments on paddy, in the last three years, indicate enhanced yields of manured fields over those not manured, from 14% to 30% for the I crop

and from 22% to 48% for the II crop in the Godavari Districts. With manure supplies ear-marked, this is the easiest way to improve production. The crop cutting experiments also show the percentage of land that got manured and the percentage in it that received supplies of cake and fertilisers from under the State Trading Schemes. The figures in the table below relate to the Godavary Districts.

	East Godavary		West Godavary	
Year and crop.	Percent of land that received manuring	Percent of land that received cakes & fertilisers from under Trading Schemes	Percent of land that received manuring	Pecent of land that received cakes and fertilisers from under Trading Schemes
(1)	(2)	(3)	(4)	(5)
1945-46				
I Crop.	53	4	46	20
II Crop.	60	49	43	17
1936-47				
I Crop	54	18	27	6
II Crop.	71	42	37	30
1947-48				
I Crop.	57	13	44	4
II Crop.	64	28	31	14

The State Trading Schemes accounted roughly to a third of the total manuring. These scheme aided by the floating capital may also merge into the Firka Development Scheme.

Present manure hunger is insatiable Green leaves, green manure and the composts are the cheapest forms for unit production. The staff under the comprehensive scheme may strain every nerve to reach the targets of production for every survey number, with suitable manuring. Ramiah and Sahasrabuddhe worked out quadratic functions to indicate the response of paddy to oil cakes at different levels in the Agricultural Stations Aduthurai, Pattambi, Coimbatore and Maruteru. These may be translated into action, in the areas served by these Stations.

6. *Seed farms on right lines.* Crop Cutting Experiments have proved beyond doubt the efficacy of departmental strains in paddy. The following from the results of crop cutting experiments show the superiority of the strains over the parent varieties.

Percentage increases of strains over locals

District	1945-46	1946-47	1947-48	Remarks.
Vizagapatam	10	15	—*	*Drought and Late Monsoon.
East Godavary	25	72*	53	*Failure with drought of dry paddy under 'local' in upland.
West Godavary	10	17	45	

Private agencies for the multiplication and distribution of improved seed are practically none and the department may have to continue its present activity in the line. Seed farms meant for pulling out rogue plants in wet land paddy would be ineffectual so long as paths to move about, are not provided at planting time, at 6 ft. distances, in the field. The owners of the crop may be compensated in this regard to permit of the operation and achieve purity in seed.

7. *Water requirements of crops, in their crucial stages.* Losses in production, with inadequate water supply in the crop maturation stage, are immense. The Agricultural Demonstrator may be commissioned with the control of the flow levels in the channels and the distributaries. He may be a member of the Irrigation Board, for his jurisdiction.

8. *Cultivable waste and mechanised farming.* In some of the northern Indian Provinces, 15 to 20% of the land, over-run by *Saccharum spontaneum* is available as cultivable waste. Such land may be straight-way put to tractor ploughing, instead of waiting to get the weed cleared by herds of cattle roaming about, for a number of years, as has been the local practice. Such lands with this weed are absent in this province. There is scope for mechanised farming in virgin land cleared from the 'partially excluded areas'. The service of tractors, gang and disc ploughs, on hire system to capitalist farmers, in areas insufficiently supplied by labour, may be continued.

9. *Fight pests and diseases as a national concern.* Crop losses due to pests and diseases amount to several crores annually. The appointment of a special demonstrator for this work to each district is the begining of the development to be undertaken in this line. Wide usage of insecticides and fungicides may be assisted under State subsidy.

10. *Markets and Prices.* "A cultivator can never protect himself against a sowcar who is both his banker and market". The hill tribes in the 'partially excluded areas' are the first to be redeemed from this pestilence. Forward transactions with mortgage of the crop in advance should be put an end to. The Firka Development body with the grain banks should take over these forward transactions and eliminate this kind of sowcar.

The Graduate Farmers of Chithradha

A Note By

S. V. DURAISWAMI AYYAR

'Back to land' by even agricultural graduates had been a failure. But it came as a pleasant surprise to hear during the recent tour in the Circars, that several non-agricultural graduates have taken up to farming as their profession in life and that they have been doing it most successfully, in the village of Chithrada, two miles to the east of Pithapuram. Most of them by virtue of connection or abilities to influence, had opportunities to enter Government service in decent jobs, but it seems they deliberately preferred to take up to farming as a profession on their own estates which varied from 15 to 50 acres. The attraction of growing sugarcane and obtaining good profits was also there. They have not regretted their decision and on the other hand they are highly satisfied to note that they are much better off than what they would have been if they had entered the much coveted service. It would be interesting to give below the financial position with the balance sheet of one who has been oldest at it and who has been able to give very reliable figures. This would give the readers an idea of the position they occupy in relation to other professions or industrial enterprises managed with the same amount of capital.

Fixed Capital:

Particulars.		Value in Rs.
Land, area owned 45 acres @ Rs. 2,000 an acre	...	90,000
Implements, carts and Miscellaneous deadstock	...	600
Petter crude oil engine and pump	...	3,000
Sinking of and construction of well	...	2,000
Value of 5 pairs work cattle including thatached Shed etc.,	...	2,500
		98,100

Charges in one year for production of crops:

Paddy 30 acres @ Rs. 150 per acre	...	4,500
Sugarcane @ Rs. 800 ,, ,,	...	12.000
Depreciation, interest charges and land revenue	...	4,000
		20,500

Receipts:

From Paddy 18 bags @ Rs. 14 per bag	...	7,560
From Sugarcane @ Rs. 1,500 an acre by supply to factory	...	22,500
		30,060
Farm labour income or nett profit	...	9 560

Percentage to capital outlay 10·5%

Note: Value of work done by permanent labour and work cattle and charges for irrigation have been included in the cost of production of crops noted above. The owner supervises all operations and no remuneration for supervision has been included under charges.

If the whole land had been given out on lease to tenant cultivators, the income would have ranged from about 7000 to 9000 rupees per annum. The owner and his family of 5 members would require at least Rs. 200 per month for decent living without anything available for savings and this amount would be derived from an area of about 15 acres. This area may be said to be an economic holding in this tract for this type of family which may be taken to represent the upper middle class.

Educated young men owning decent areas of land in their families and intending to take up to farming, may with advantage visit this village and be benefitted by the experience gained by the graduate farmers.

"Starvation of the soil is the root cause of our own starvation. Mother Earth is truly a living being, and if we do not nourish her she cannot nourish us."

— Shrimati Mira Behin.

Proceedings of the Agricultural Economics Conference at Hyderabad, December 1948

(Discussion on "Grow More Food" Problem)

Sir S. V. Ramamurthi, in his Presidential address at the 9th Agricultural Economic Conference held at Hyderabad in December last, dealt in the main with the problem of food for India. He had made a close study of it as an administrator and as a member of the Indian Famine Commission. He said: For over twentyfive years now the production of cereals in India was practically stationary while population was growing at the rate of one per cent per year, who required half a million tons of rice at the rate of 1 lb. per day. We had to import more than two million tons of rice a year before the war. With the stoppage of imports from Burma and Siam, the situation worsened. These countries were not yet able to supply us the needed quantity. The separation of Pakistan meant a deficit of one million tons of wheat. India had to import cereals to the tune of Rs. 100 crores a year.

Our deficit of cereal production was only 10 per cent of consumption. The deficit could be made good according to experts by reclamation of waste land, increased supply of water through schemes of irrigation, use of improved seeds, fertilizers and insecticides, etc. But the Grow More Food Campaign offering aid and advice in these matters produced poor results. In the opinion of Sir S. V. Ramamurthi, what was needed was an 'integral effort' of the kind which was made by him in bringing under cultivation 60,000 acres of land under the Mettur Irrigation area, and supplying the same with sulphate of ammonia. He had 60,000 new wells dug in the central dry districts by offering a subsidy of a crore of rupees from the Government. What was needed was a very sympathetic administration; it was only then the advice of experts would be followed and the deficit of ten per cent would be made good.

But he said this was not enough. We want more food, better food and a higher standard of living. The vast unused lands of India should be reclaimed and cultivated. The multi-purpose river schemes should be executed to get not only more water but cheap electric power to yield "a more variegated economic life than a mainly agricultural economy". He was of the view that agriculture could safely maintain only 60 per cent of the population. The rest should be absored in layers of industry-cottage, small-scale and large-scale-with the learned and artistic professions at the top. He expected electricity to play a great part in such an industrial reorientation. It could be applied in small units though produced in the mass. It could serve the needs of agriculture, industry, commerce and social life.

The last session of the Conference was devoted to the discussion of the "current topic" — "the Grow More Food Problem" in which several members participated.

Prof. V. K. R. V. Rao of the Delhi University initiated the discussion. He said the shortage of food was a world problem, as F. A. O. publications revealed. In India there was on the whole, an extension of acreage under food crops, but the yield did not increase appreciably, due to unfavourable seasons. In Bombay short staple cotton gave place to groundnut and not millets. Targets of production should be fixed only after ascertaining the level of consumption. Procurement should be done only from substantial farmers and not from those who had a large margin of unsatisfied demand. Mechanization of cultivation seemed to him to be a racket, not easy to apply on most of the holdings. Reclamation of waste land was not possible without stamping out of malaria. Co-operative farming would take time, if it came at all. Improved strains were not yet popular, in the case of millets. He wanted a mission to go out to China and Japan to find out how small holders there, were able to produce higher yields per acre and instruct farmers here on those methods. Prices of cereals should be guaranteed for a few years. Good farmers should be awarded prizes.

Sir S. V. Ramamurthi pointed out that these methods would not solve the problem of more food, which was urgently wanted. He suggested a change over in diet; production and consumption of tubers, potatoes and sweet potatoes to supplement cereals.

Dr. B. Natarajan, Economic Adviser to the Government of Madras, said that the problem of deficit, though longstanding grew acute only in the last four years. The production of 1938—43 which was 7·3 million tons of grains, was enough to feed the present population at 16 oz. per diem per adult. Experts held that the use of improved seeds would raise production by 10 per cent and the application of manures by another 8 per cent. But little progress has been achieved—partly due to bad seasons. There has been, on the other hand a great shrinkage in area under millets—from 13 million to 11 million acres. Groundnut has in most cases taken the place of millets. The area under food crops should be increased; at any rate it should not be cut down. Prices of food crops should not be too low compared with those of commercial crops. Some parity should be established between the two. There were 20,000 old tanks which could be renovated at a cost of Rs. 8 crores (less than one year's land-revenue of the Province), which could be spread over a few years, and the work entrusted to village panchayats who should give preference in employment to the scheduled classes and the unemployed.

Prof. J. J. Anjaria (Bombay) said that guaranteeing prices would not bring in more food; as already prices were very high. Nothing short

of an agricultural revolution in the system of land-holding was likely to produce appreciable results. Prof. K. T. Merchant (Bombay) said that more food was wanted not only now but progressively in the future as population was growing. There must be an austerity drive. "Conspicuous consumption" of all kinds, especially on social occasions, should be cut down.

Dr. J. S. Patel (Bihar) was of the view that the Grow More Food Campaign was not such a failure as made out. There was no correct estimate of production nor of consumption on the farm. The campaign to grow more food should not be relaxed; if it were, there would be a cry for its revival as in the case of food rationing.

Dr. S. V. Dakshinamurthy (Malaria Research Institute, Delhi) said that control of malaria in parts of Orissa, Bihar, Central Provinces and Hyderabad, inhabited largely by a sparse population of aborigines, would help increase of rice production to the tune of 3 million tons of rice on about 10 million acres of land.

Prof. R. V. Rao (Hyderabad) claimed that hand pounding of rice would yield 10 percent more of rice, which was more nutritious.

Mr. L. C. Sircar (West Bengal) said that a change in diet was a long range proposition. Even if tubers were so desirable, not all lands were suitable for growing tubers; and they were more perishable than cereals.

Mr. Mallinath (Mysore) said that the Agricultural Department should not be blamed. The Revenue Department gave lands to people who wanted property and were not interested in growing more food crops. The growing of summer ragi was a success in Mysore, due to effective demonstration and award of prizes to growers.

Mr. D. V. G. Krishnamurthy (Hyderabad) said that in spite of special steps taken by the State, the increased yield of cereals was only 40,000 tons on account of unfavourable seasons and the low ceiling prices. The area under groundnut which had doubled was brought down after 1947 by the imposition of heavy penalty on growing the crop in excess of the limits prescribed under the Cash Crop Restriction Regulation. The area under short staple cotton was brought down drastically, but in its place groundnut and linseed were grown. Area under sugarcane increased uninterruptedly on account of high prices offered. The Grow More Food Campaign and the Price Control and Procurement policies seemed to work at cross purposes. Liberal subsides should be given to food growers of the State in preference to paying high prices for imported grains.

Mr. S. K. Bedekar (Bombay) spoke of the steps taken in Bombay to compel the cultivator to put a minimum of his holding under food crops and prevent him from growing more than a proportion of his holding under commercial crops. This was felt as a grievance. The cultivator was now content to grow just enough of food crops for his family and not more for an unremunerative price. Why produce more and deliver so much of it at low prices?-he argued. It was difficult to change his psychology.

Sir S. V. Ramamurthi, in his concluding remarks, observed that it was not so difficult to effect a change in the psychology of cultivators as to bring about a change in economic conditions.

We are indebted to Sri K. C. Ramakrishnan, M. A., for the above account of the conference. Ed. M. A. J.

Review.

Agrarian Reforms and Parity Economy by the Honourable Sri O. P. Ramaswami Reddiyar, Premier, Government of Madras and Member, Agrarian Reforms Committee of the A. I. C. C. *(published by the Economic Adviser to the Government of Madras, 1948).* In this pamphlet prepared for the Agrarian Reforms Committee, the Premier of Madras pleads for a fairer treatment of agriculturists than has been accorded to them so far. For more than a hundred years agriculture has been exploited by trade and industry. He is not for a return to peasant economy run on primitive lines. He is anxious to see that the benefits of science are so utilised as to create a more harmonious society and agriculture benefits at least to the extent that commerce or manufacture does. This he calls parity economy.

He would prefer a comprehensive co-operative organisation as the best means to achieve his ends. He would compel all agriculturists to join it and would like to have grain banks attached to them, which would serve a number of purposes and help to stabilise agricultural prices. He would entrust a number of functions to the co-operative organisation — including digging of canals, laying out roads, building, schools and even joint farming. The co-operative common wealth "will usher in an epoch of prosperity and self-reliance in villages" — not all at once but by stages.

Meanwhile, he indicates certain urgent lines of reform — compulsory consolidation of holdings, prevention of sub-division of holdings below the economic limit, ensuring a fair share of agricultural income to the labourer, the tenant and the land owner supplying capital and direction. A necessary preliminary to the latter is, in his view, an assurance of minimum prices for agricultural produce on a parity with prices of manufactured goods, after a close analysis of cost accounts at all stages — which is by no means easy. He thinks that there is no need for Land Alienation Act nor for local land tribunals, except occasionally for decision of tenancy disputes.

In the place of the existing land revenue, he is for the levy of a basic tax on all lands and on the top of it a graduated tax on higher agricultural incomes. Renovation of tanks at a cost of Rs. 15 crores to 20 crores is even more urgent as protective works than the giant production works of Tungabadra, Ramapadasagara etc., which will add greatly to the agricultural wealth of the country.

We are glad to note that the Premier has abundant faith in the possibilities of scientific research in agriculture which, he urges, the state will have to continue "to an increasing extent for a long time to come" though the onus of financing industrial research will have to be shifted to the shoulders of industrialists as in the West — "when agricultural research will receive a fillip". The application of fruits of agricultural research to practical agriculture in an ever wider measure is a problem that needs more attention meanwhile.

HINTS TO FARMERS

Sorghum smut. Sorghum is one of the staple food-crops of our Province. This crop is very often affected by a disease called smut. It is prevalent in all districts especially in the crops raised in the colder months. Dirty grey bodies about half to three fourths of an inch in length develop in the place of grains on the affected plants. All the grains in a head may be thus transformed or a portion of the head may be involved. When crushed between the fingers, these bodies are found to be filled with a black powder, the spores of the fungus which causes the disease. The economic effect of the disease is in the reduction of the yield of grains.

The disease is seed borne. Since the spores of the smut fungus are attached to the seeds, the disease can be completely controlled by disinfecting the seed with finely powdered sulphur before sowing. The seeds are thoroughly mixed with sulphur using one ounce of the powder for every 15 pounds of seed. When the quantity of seed is small, the sulphur powder and the seed are placed in a closed tin or earthern vessel

and thoroughly shaken for 15 minutes. But when larger quantities are involved special seed-dressing drums are used. By this simple treatment the seeds get a coating of sulphur. When such treated seeds are sown, the infection of seedlings is prevented and the crop will be free from disease.

Though sulphur is not readily available in the market, the Agricultural Department has taken pains to stock and supply needs of cholam growers. Sulphur can be had from the nearest Agricultural Demonstrator in packets of 4 ounces each, sufficient for treating 50 pounds of seed.

Control of "damping off" in tobacco nurseries. The most serious disease commonly met with in tobacco nurseries is "damping off" of seedlings. This disease is found to take such a heavy toll that the area under nurseries every year is usually twice the required area so that the loss works out to about 50 per cent of the crop of seedlings produced.

Before 1924, it was usual to raise these nurseries in black soil areas adjacent to the fields prepared for transplanting purposes. As the destructive nature of the disease was found to be very severe in these heavy soils, it was thought that the sandy areas might be more suitable for raising the tobacco nurseries. In 1924 the I. L. T. D. Co. raised 10 acres of nurseries in the sandy area at Chirala. Since then the area has increased considerably and now the major portion of the nurseries is found only in the sandy soils. Though the sandy areas have found to be ideal for tobacco nurseries it has not been possible to check the ravages of "damping off". Even here the toll due to the disease was quite heavy when favourable conditions for the disease prevailed.

The disease is caused by a fungus which is a natural inhabitant of the soil. This organism causes the tissues of the lower portions of the stem to collapse near the ground level with the result that affected seedlings topple over, lie flat on the soil. Then the leaves and stems begin to decay rapidly.

Control. When conditions are favourable for the outbreak, the disease appears all of a sudden and spreads very rapidly sometimes damaging entire seed-beds overnight. Hence curative measures after the appearance of the disease are useless. The following preventive measures have been found quite successful in controlling the disease both in the sandy as well as black soil areas :—

(1) On the 20th day after sowing, the seed-beds should be sprayed with 1 per cent Bordeaux Mixture, at the rate of 500 gallons per acre.

(2) Two more sprayings should then be given at intervals of a fortnight.

Gleanings.

Better Yeast is Made. A new process for the manufacture of bakers' yeast -- conceived, researched and developed in Australia, is now on the way to improving the world's yeast industry and the world's bread. The new yeast has infinitely superior qualities and keeps for long periods without deteriorating even in a warm climate. It is known as the 'Deloffre Alcohol Process' after its inventor who took out world patent rights in 1940. Under the new process, many materials, additional to those generally employed, can be used but the yeast is formed in one operation, instead of several, by inoculating a highly concentrated sugar solution with a small culture of pure yeast, which is then fermented to produce a maximum quantity of alcohol. This is then used to form yeast under special conditions, produced to set up the required biological reactions under which yeast can absorb alcohol. Advantages of the process are many. Not only does it simplify the process of manufacture, but it reduces cost of production by about 30 per cent., while increasing the yield by from 20 to 25 per cent. One reason for the great saving in cost is that the mixture can be worked in much more highly concentrated forms than previously. Due to the high proportion of alcohol in the fermenting liquid, fermentation takes place under almost sterile conditions. The several operations necessary with the older processes made the growth of bacteria difficult to prevent. Further, the new process yeast is of exceedingly high keeping quality, because the alcohol reduces considerably the content of potease enzyme which is the agent of decomposition. Deloffre Process yeast has greater baking qualities with its substantially greater levening powers, since it reacts in higher degree on the flour to generate a greater quantity of carbon dioxide gas. Less yeast need be used and because of its higher keeping quality, immediate use is not so necessary. During the war, when beet molasses was unobtainable, wheat starch was transformed into glucose which, in turn, was transformed into alcohol for use in the Deloffre Process. For manufacture of the yeast, a special all-steel building was designed and equipped with machinery almost entirely Australian-made. Pipelines for conveying the mixture from apparatus to apparatus were kept at minimum length while ensuring production of yeast, untouched by hand, that had good lasting qualities. They were so constructed that proper sterilisation was possible after each operation. Entire process was automatic. Australia used something like 8,000,000 lb. of bakers' yeast each year. By 1948, some 80 per cent. of the fresh yeast used in Australia for baking purposes was made by the Deloffre Alcohol Process.

(Agricultural Newsletter No. A. G. N/230).

Agricultural College and Research Institute Library, Lawley Road, Coimbatore.

MONTHLY LIST OF ADDITIONS FOR JANUARY 1949

1. HAMILTON (W. J.): American Mammals, their lives, habbits and economic relations — 1932
2. WOLCOTT (Robert H.): Animal biology, Edn. 3 — 1946

Crop and Trade Report.

Raw Cotton. The receipt of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1948 to 31st January 1949 amounted to 366,614 bales of 400 lb. lint as against an estimate of 283,700 bales of the total crop of 1947—48. The receipts in the corresponding period of the previous year were 417,426, bales. 561,073 bales mainly of pressed cotton were received at spinning mills and 35,253 bales were exported by sea while 122,922 bales were imported by sea mainly from Karachi and Bombay. (From the Director of Agriculture, Madras.)

Weather Review—For January 1949.

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	0·2	−0·1	0·2
	Calingapatam	0·1	−0·6	0·1
	Vizagapatam	0·4	+0·1	0·4
	Anakapalle*	0·2	+0·1	0·2
	Samalkot*	Nil	−0·1	Nil
	Kakinada	Nil	−0·5	Nil
	Maruteru*	Nil	−0·1	Nil
	Masulipatam	Nil	−0·5	Nil
	Guntur*	...	...	...
	Agri. College, Bapatla	Nil	...	Nil
	Veeravanam (College Farm)	Nil	...	Nil
Ceded Dists.	Kurnool	Nil	−0·3	Nil
	Nandyal*	Nil	Nil	Nil
	Hagari*	Nil	−0·1	Nil
	Siruguppa*	Nil	Nil §	Nil
	Bellary	Nil	−0·2	Nil
	Rentichintala	Nil	...	Nil
	Cuddapah	Nil	−1·2	Nil
	Anantharajpet*	Nil	−0·7	Nil
Carnatic.	Nellore	Nil	−1·7	Nil
	Buchireddipalem*	Nil	−3·4	Nil
	Madras	Nil	−5·2	Nil
	Tirurkuppam*	Nil	−2·5$	Nil
	Palur*	Nil	−2·0	Nil
	Tindivanam*	Nil	−1·7	Nil
	Cuddalore	Nil	−7·3	Nil
Central.	Vellore	Nil	−3·5	Nil
	Gudiyatham*	Nil	−0·8	Nil
	Salem	Nil	−0·9	Nil
	Coimbatore (A. C. R. I.)*	Nil	−0·8	Nil
	Coimbatore (C. B. S.)*	Nil	−0·8	Nil
	Coimbatore	Nil	−0·9	Nil
	Tiruchirapalli	Nil	−3·3	Nil ‡

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	0·5	−2·9	0·5
	Adurai*	0·3	−2·1	0·3
	Pattukottai*	0·4	−1·2	0·4
	Madurai	0·9	−0·5	0·9
	Pamban	6·2	+5·8	6·2
	Koilpatti*	0·6	−0·5	0·6
	Palamcottah	0·3	−1·4	0·3
	Ambasamudram*	1·2	−1·9	1·2
West Coast.	Trivandrum	0·3	−2·5	0·3
	Cochin	Nil	−1·7	Nil
	Calicut	Nil	−0·7	Nil
	Pattambi*	Nil	−0·3	Nil
	Taliparamba*	Nil	−0·1	Nil
	Nileshwar*	Nil	−0·3	Nil
	Pilicode*	Nil	−0·6‡	Nil
	Mangalore	Nil	−0·6	Nil
	Kankanady*	Nil	−0·3	Nil
Mysore & Coorg.	Chitaldrug	Nil	−0·8	Nil
	Bangalore	Nil	−0·5	Nil
	Mysore	Nil	−0·5	Nil
Hills.	Mercara	0·1	−0·4	0·1
	Kodaikanal	0·9	−3·7	0·9
	Coonoor*	Nil	−5·1	Nil
	Ootacamund*	Nil	−1·5	Nil
	Nanjanad*	Nil	−1·5	Nil

Note :— (1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal.

(3) $ Average of seven years for Tirurkuppam, and eight years for Pilicode is given as ten normal.

(4) § Taluk office rainfall is Nil

(5) ‡ The actual rainfall was 0·01".

(6) ... Figures not available.

Weather Review for January 1949.

On the very first day of the month conditions were markedly unsettled in the South-west Bay of Bengal; but the very next day they became unimportant. The western disturbance over the South-west Punjab moved over the North-west Punjab and after a stay of a day, these moved away Eastwards across the hills of East Punjab and the West United Provinces.

In the latter half of the first week of the month, cold wave was experienced in East Rajputana, East Punjab, the West United Provinces, Madhya Bharat and Bhopal, as a result of which the temperatures in these places were below the freezing point.

A number of mild and unimportant western disturbances occurred in the South-west Bay of Bengal.

The weather, on the whole, was practically dry throughout the country. A few light shower occurred in a scattered manner in isolated parts of Tamilnad, Andhradesa and Rayalaseema. The only noteworthy fall in this month was at Pamban to the tune of 3·7" on 1—1—1949. On majority of days the night temperatures were generally below normal; but towards the end of the month, they were fairly above normal.

Reviewing the monsoonic weather conditions of 1948, it can be briefly stated, as pointed out in a general manner by the Food Secretary to the Government of Madras, that the South-West and the North-East, monsoons were not upto normal respectively in fourteen and twelve districts out of 25 districts. In districts like Cuddapah, Nellore, Chingleput, South Arcot, Chittoor, North Arcot, Tiruchirapalli and Tanjore, both the monsoons were below normal.

Regarding the performance of cultivated crops in these districts it is rather early to say anything definitely. It may be stated in general that the previous year — 1948 — was bad so far as the rainfed crops were concerned.

M B. V N. & C. B. M.

OBITUARY.

We regret to record the death of T. Gopala Rao, M. Sc., who was Botany Assistant, Coimbatore, on 30—1—1949 at his home, after a short illness.

We offer our heartfelt sympathies to the members of the bereaved family.

Departmental Notifications

GAZETTED SERVICE—POSTINGS AND TRANSFERS

Name of officers	From	To
Sri Abishaekanatham Pillai, A.	Dy. D. A. and Curator, Ootacamund,	Regional Dy. D. A., Coimbatore.
,, Bhushanam, K.	On leave,	D. A. O., Vijayavada.
,, Gopala Unnithan, M.	On leave,	D. A. O., Chittoor.
,, Nagarajan, K. R.	Entomology Assistant,	Assistant Entomologist.
,, Krishnamurthi, C. S.	Mycology Assistant,	Assistant Mycologist.
,, Palanivelu, T. S.	Assistant to the Research Engineer, Coimbatore,	Assistant Agricultural Engineer, Madras.
,, Ram Mohan Rao, A.	D. A. O., Chittoor,	A. M. O., Cuddapah.
,, Raju, C. P.	On leave,	Lecturer in Engineering, Bapatla.
,, Seshadri Sarma, P.	A. M. O., Nagpur,	A. M. O., Patiala.
,, Sankaran Nambiar, M. P.	Regional Dy. D. A., Coimbatore,	Dy. D. A., Tanjore.
,, Subramanian, T. V.	Mycology Assistant,	Assistant Mycologist.
,, Somayya, M.	D. A. O., Ellore,	D. A. O., Kurnool.
,, Vasudeva Rao Naidu, R.	On leave,	Sugarcane Specialist, S. R. S., Anakapalle.
,, Viswanatha Reddy, D.	A. M. O., Cuddapah,	On deputation to Sholapur.

SUBORDINATE SERVICE
POSTINGS AND TRANSFERS

Name of officers	From	To
Sri Adinarayana Reddy, G.	A. D., Atmakur,	A. D., Nellore.
Sri Appayyan, M. C.	A. D., Papanad,	A. D., Orthanad.
,, Chandrayya Naidu, N.	A. D., Rapur,	A. D., Ambasamudram.
,, Hanumantha Rao, D. C.,	A. D., Vinukonda,	A. D., Sompeta.
,, Hanumantha Rao, C.	A. D., Anakapalle,	F. M., A. R. S., Anakapalle.
,, Krishnamaraju, K.	Assistant in Mycology, Ellur,	Assistant in Mycology, Coimbatore.
,, Krishnamurthi Iyer, A. K.	On leave,	A. D., Vriddachalam.
Janab Khadar Razak Sahib,	A. D., Sidhout,	A. D., Vinukonda.
,, Lakshmi Reddy, M.	Assistant in Cotton, Gurzala,	A. D., Anantapur.
,, Mahadeva Iyer, S.	A. D., Tanjore,	Special A. D, C. M. P., Area Tanjore.
,, Madhava Rao, B.	A. D., Narasapatam,	A. D., Vizagapaatm.
,, Nagabhushana Rao, Y.	A. D., Vizagapatam,	A. D., Narasapatam.
,, Narayana Reddy, B.	A. D., Anantapur,	A. D., Hindupur.
,, Nageswara Sarma, D.	A. D., Kandukur,	Plant Protection Assistant, Nellore.
,, Narasa Reddy, I.	Assistant in Millets, Coimbatore,	A. D., Atmakur.
Mr. Ponnaiah, B. W. X.	On leave,	Assistant in Millets, Coimbatore.
Sri Pitchayya, B.	Assistant in Paddy, Tirurkuppam,	F. M., Agricultural College, Bapatla.
,, Prakasam, P.	Assistant in Entomology, Ellur,	Assistant in Mycology, Ellur.

Name of officers	From	To
Sri Ramalingam, G.	On leave,	A. D., Kandukur.
,, Rayappa Pillai, M.	On leave,	Assistant in Paddy A. R. S., Tirurkuppam.
,, Ramanathan, G.	Assistant in Paddy R. R. S., Tirurkuppam,	Assistant in Chemistry, Coimbatore.
,, Ramunni Kidavu, V. M.	On leave,	F. M., A. R. S., Pattambi,
,, Rajapadmanabhan, A. K.	F. M., A. R. S., Pattambi,	A. D., Gingee.
,, Raghavulu, G. V.	On leave,	Marketing Assistant, Tenali.
,, Sanker Reddy, G. H.	Assistant in Chemistry, Coimbatore,	Assistant for Training in soil conservation, Sholapur.
,, Satyanarayana Rao, G.	P. A., to D. A. O., Saidapet,	A. D., Palumaneir.
,, Seshadri, T. V.	Assistant in Mycology,	Assistant for Training in soil conservation Sholapur.
,, Sundara Raj, J. S.	Fruit Survey Assistant,	Assistant in Fruits F. R. S., Kodur.
,, Subba Rao, P.	A. D., Hindupur,	A. D., Cheepurupalle.
,, Subramania Iyer, D. S.	A. D., Periakulam,	Special A. D., for Firka Development Work, Tirumangalam.
Janab Sheik Hussain	A. D., Nellore,	Marketing Assistant, Nellore.
Sri Seshagiri Rao, M.	Assistant in Fruits, Kodur,	A. D., Repalle.
,, Sudarsanam Naidu, P.	On leave,	Teaching Assistant Agricultural College, Bapatla.
Janab Sheik Ahmadullah Sahib,	On leave,	A. D., Siddhout.
Sri Thandavarayan, K.	Botany Assistant, Aduthurai,	Assistant in O. S. S., Coimbatore.
Mr. Thomas, M.	A. D., Puthur,	A. D., Papanad.
Sri Varadarajulu Naidu, S.	On leave,	F. M., Agricultural College, Bapatla.
,, Venkataraghava Raju, S.	A. D., Anantapur,	A. D., Kalyandrug.
,, Venkata Reddy, J.	Assistant in Cotton, Siruguppa,	Assistant in Cotton, Guizala.
,, Veeraiah, Y.	A. D, Palamaner,	F. M., Livestock Station, Guntur, Lam, P. O.

THE MADRAS AGRICULTURAL STUDENTS' UNION.

This is an association of the students, past and present, of the Madras Agricultural College, and of the officers of the Madras Agricultural Department, the Principal of the Agricultural College being the President, *ex-officio*. The Union conducts this Journal and celebrates annually the College Day on which occasion it convenes an Agricultural Conference. The Association has Members, Associates, Honorary Members and Patrons. For detailed particulars apply to the Secretary.

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Contributions on subjects of agricultural interest or pertaining to rural economics and co-operation will be accepted for publication, subject to approval of the Editorial Board. Correspondence and queries on agricultural and allied subjects are invited. Manuscripts should be sent clearly written or typed on *one side of the paper* only.

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All communications should be addressed to:

The Secretary, M. A. S. Union,

Agricultural College, Lawley Road P. O., Ciombatore.

The Madras Agricultural Journal

Vol. XXXVI MARCH 1949 No. 3

CONTENTS.

TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high — and the Editorial Board will feel obliged if your articles are brief.

The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI March 1949 No. 3

Editorial

Ceiling Prices and Cost of Production: In the December issue of the Madras Agricultural Journal, we published an article from a contributor from Tinneveli, on the economic price of paddy. A correspondent from South Canara whose letter is published elsewhere in this issue takes us to task for publishing the article without our comments. We may state at once that as a general rule the Editorial Board does not hold itself responsible for the opinions expressed by its contributors, nor can it vouchsafe for the correctness of the figures furnished by them in supprt of their opinions. But in this particular instance it so happens that we agree with the main contention of our Tinneveli contributor viz., that when ceiling prices are fixed by the Government due consideration should be given to the cost of production and at the same time the cultivator should be guaranteed a reasonable margin of profit. To this proposition no one could take any objection. But divergent opinions may be justifiably held regarding the actual cost of production in relation to different crops and in determining what constitutes reasonable margin of profit. We hold that the figures by Mr. A. Chidambaram Pillay with regard to cost of cultivation are reasonable. The price of land which has been taken at Rs. 6,000 in the Tinneveli district, we believe, is the prevailing price obtaining in the locality. The tract is very fertile and the yield of 5,600 lb. per acre is about the highest in the Province

Now as regards the margin of profit, we note that Mr. Pillay has added Rs. 270 to the cost of cultivation representing 4½% interest on the capital outlay and allowed a margin of 5 kottas per year against bad years. The question arises whether 4½% is a reasonable rate. Considering that in other enterprises this rate of dividend is normally obtained and taking into consideration the prevailing bank rates many of our readers will agree that the rate fixed by Mr. Pillay is not unconscionably high. For, be it noted that the entire profit to the cultivator is merged in this amount and there is no reason why the producer

of food should be at a disadvantage in comparison with producers of other commodities. But then food should be produced and made available to the consumer at prices which he can afford. Here comes the difficulty for the Government in fixing ceiling prices, and the periodical revisions of prices bear evidence to this difficulty and every attempt is made to reconcile the interest of the consumer and producer to the extent possible under given set of circumstances.

Mr. Savur has stated that he has been able to secure land at Rs. 60 an acre and he finds his agricultural enterprise profitable, but he forgets that the ceiling price of paddy in his district is more or less the same as in the districts where an acre of land costs one hundred times more. From what we know of the Tirunelveli cultivator, we do not consider him less efficient or less enterprising than cultivators in other parts of the Province. Cost of land and labour varies within wide limits in our Province and is dependent on various factors over which the cultivator has no control and therefore it is inevitable that the margin of profit also varies from tract to tract when a more or less uniform selling price is fixed for the entire Province.

Our Agricultural graduates: We understand that many of the Agricultural graduates who passed out last year still remain unemployed. One would have thought that the last group of persons to remain unemployed under the present circumstances would be those who have equipped themselves with special knowledge in Agriculture. Not a day passes without some important person or other, making a statement about the 'food crisis' and the need for increasing production. Plans and schemes there are in plenty and we believe it is intended that some of them should be implemented. The plea that schemes are being held up for lack of trained personnel cannot be advanced in this instance, and it will be agreed that the alumni of the two Agricultural colleges in the Province have justifiable reasons to feel frustrated, if their talents are not utilised in this emergency. While in normal times Government cannot undertake to provide employment for every graduate who takes his degree in Agriculture, we are of opinion that the present crisis warrants the absorbtion of all available talent for furthering the cause of increased food production.

A Soil Survey for Fruit Development in the Ceded Districts

By

Sri. G. K. CHIDAMBARAM, M. SUNDARAM

and

N. RAGHUNATHA RAO

(Agricultural Research Institute Coimbatore.)

Introduction: The importance of the fruit industry and its great value to the health and economy of the country have received adequate attention only in recent years and with the aid of grants from the Indian Council of Agricultural Research several fruit research stations have been established all over the country. The climatic, soil and water conditions over several areas in this presidency are so favourable that considerable extension of the area under fruits is possible. The per capita consumption of fruits is very low in this country. It is recognised that fruits, in addition to forming a wholesome article of diet, are good sources of vitamins and minerals, provide bulk and possess laxative properties. The higher income per acre from land devoted to fruits must be an additional inducement for the extension of the area under fruits. Incomes of as much as Rs. 5,000/- per acre have been obtained in some of the cheeni growing areas in the Ceded Districts. A family can earn a living from a smaller area devoted to fruits than would be required were ordinary farm crops grown. The development of the fruit industry would thus have far-reaching consequences on the health and economy of the country.

Scope of the survey: The object of the survey was to assess, from an examination of the soil and subsoil layers, drainage and facilities for irrigation, the suitability of the following areas in the Ceded Districts for fruit cultivation :—

	Area.	*Taluq.*	*District.*
1.	Kottur-Ujjini	Kudligi	Bellary
2.	Rudravaram	Sirvel	Kurnool
3.	Giddalore-Diguvameta	Cumbum	Kurnool
4.	Vontimitta Valley	Sidhout	Cuddapah
5.	Kodur Firka	Rajampet	Cuddapah

Field work: Preliminary traverses of the areas were made before deciding on the location of the pits so that the soil samples taken would be representative of as large an area as possible. The profile pits were generally dug to 8 feet depth except in cases where either the water table or hard rock was met with earlier. The exposed layers of soil were then examined and samples representing each foot depth of

soil generally taken. Field notes were recorded regarding the nature of the soil at various depths, the drainage, facilities for irrigation, potentialities for sinking wells, the depth of the water table in summer and in the rainy season and the quality of the water. Samples of water from irrigation sources were taken for analysis. Samples of soils and water were also taken from existing orchards, if any, in the areas surveyed

80 profile pits were dug and 426 samples of soil and 51 samples of water were taken and despatched to Coimbatore as shown below:—

Area	No of profile pits	No. of soils samples	No. of water samples.
1. Kottur-Ujjini	15	61	6
2. Rudravaram–Sirvel	18	93	8
3. Giddalore-Diguvametta	14	76	11
4. Votimitta valley	15	71	12
5. Kodur Firka	16	109	12
6. Panyam	2	16	2
Total ...	80	426	51

Brief accounts of the salient features of the various areas are given below :—

1. **Kottur-Ujjini**: There is an attractive stretch of red-soil area on either side of the Kottur-Ujjini road. The red soils are mainly derived from granites with pegmatite veins. On the ridge lines it was not uncommon to find the surface strewn with quartz fragments as big as hen's eggs. Over the greater portion of the area the soils are of very poor depth (2-3 ft.). The surface soils are sandy to sandy loam in texture but the subsoils are heavier. The soils in the valley lines are deeper (5–7 ft.) and heavier and the colour reddish–brown. Near Ujjini shallow, heavy black soils are met with. Irrigation wells in the area are few ; the water table is very low (over 60 ft.) and the water brackish. In view of the very low water table the cost of sinking wells is high, an irrigation well easily costing Rs. 2,000/– and there is no guarantee of the supply of sweet water. In the valley lines as at Kalapuram the water table is more favourable, being situated at 40-45 ft. and the quality of the water fairly good. These somewhat favourable conditions are confined to small and very restricted areas and over the major portion of the area, water supply is the biggest problem, no other sources of irrigation being available. It is no

wonder, than, that orchards are not to be seen anywhere in the area. The gently rolling nature of the country and the topography are favourable to drainage. Considerable soil erosion is in evidence. In common with the western taluqs of the Bellary District, the locality receives higher rainfall than the remaining portions, the average annual rainfall being 25" mostly favoured by the S. W. monsoon (June to September). As regards transport facilities Kottur is well connected by road and rail with Hospet and Bellary. But the Kottur-Ujjini road is very bad and requires considerable improvement.

Rudravaram—Sirvel area: Rudravaram is situated at the foot of the Nallamalais and is about 10 miles from Allagadda, the taluq headquarters and 9 miles from Sirvel. The outstanding features of the Rudravaram—Sirvel area high water-table and good water. Sirvel and the surrounding villages have large areas under fruits and are well known as an important fruit-producing centre. In view of the considerably higher returns per acre from land devoted to cheeni culture there has been considerable extension of the area under fruits in recent years in Sirvel. In Rudravaram just the beginnings have been made.

The soils of the area are mostly derived from Cuddapah formations. The surface soils are generally brown in colour and loamy in texture and the subsoils are yellowish-brown and heavier in texture with very often high proportions of rounded ferruginous gravel in the deeper layers. In and around Sirvel the soils are comparatively shallow, rocks of the Cuddapah formations being met with at the third or fourth foot. In spite of the comparatively shallow soils and high water table (reaching to within 4-5 ft. in the rainy season) which are far from ideal conditions from the point of view of commercial fruit culture, some flourishing orchards are seen in the area and net profits of as much as Rs. 5000/- per acre have in some instances been obtained from Cheeni gardens. In view of the high water table the gardens will naturally be characterised by a short life All the cheeni gardens in the area are comparatively young and it remains to be seen how the high water table will affect the life of the fruit trees. The high water table is also believed to lead to the fruits being insipid and the keeping quality poor. In spite of these adverse factors, there has been considerable extension of the area under fruits due chiefly to the considerably higher returns from land devoted to fruits. In the Rudravaram area sufficiently deep soils for profitable fruit growing are met with. There are stretches of red soils, sandy loam to loamy in

Kodur: The average annual rainfall of this area is 38", about one third of this being received in the S. W. monsoon period and the remaining two-thirds in the N. E. monsoon period. Kodur is well known as in important fruit-producing centre and famous for its Sathgudi oranges, limes and mangoes. There are about 7,000 acres of cheeni gardens and 10,000 acres of mango gardens in Rajampt taluq and the contribution of Kodur firka to the area under fruits in the taluq is quite considerable. The outstanding feature of the area is the occurrence of very deep soils (more than 8ft.) over the greater portion of the firka. The soils are mainly derived from quartzites and are in general red to reddish-brown in colour and loamy in texture right down to 8 ft., thus permitting good root developement. Being derived from quartzites the soils are comparatively poor soils, lacking in the essential plants nutrients. Their success for fruit growing must be attributed to the good depth and favourable physical properties. The water table is quite favourable, being situated at 20-30 ft. and the quality of the water good. Wells form the main source of water-supply for the areas under fruits. The area surveyed includes the following villages: — (1) Pagadalapalli, (2) Rachapalli, (3) Balireddipalli, (4) Satram, (5) Reddivaripalli, (6) Kichchamma Agraharam, (7) Chiyyavaram, (8) Kapupalli, (9) Anantarajupeta, (10) Mangampet, (11) Settigunta, (12) Janakipuram, (13) Maisurivaripalli. In Settigunta there is a compact block of 600 acres of waste land and the utilization of this area for a land colonisation scheme was purposed some time back. It is understood that trial borings by the Industries Department to tap sub-soil water did not meet with success and the scheme has been given up. Kodur is well connected by rail with good marketing centres for fuits but the road communications in the area require considerable improvement.

Panyam: With a view to getting an idea of the conditions obtaining in an ideal orchard and comparing the analytical data with those obtained for the soils collected in the course of the survey, soil samples were drawn from the famous Jaganmohini and Manoranjini gardens of Messrs P. V. Madhava Rao and brothers of Panyam, nurserymen and horticulturists of repute. One pit was put in the mango garden area, which consists of sandy soil and the other in the cheeni garden area which consists of very rich black loamy soil. The soils in both areas are of considerable depth, possess ample natural reserves of calcuim carbonate and are well-drained soils, the water table being situated at 40 ft. There are practically no wells in the area and the orchards and wetlands are supplied with water by a big tank fed by

a perennial spring from the Erramalai hills and the water is excellent in quality. Water is not available for irrigation throughout the year.

An interesting sample of incrustation that forms on the black soils round about the tank during the summer and which is gathered and applied as manure to cheeni trees which are said to benefit considerably from the application, was collected and analysed. The incrustation has been found to contain 0.65% of nitrogen (practically the whole of it in the form of nitrates), 0.59% of P_2O_5, 3.1% of lime and 1.34% of potash. The water-soluble salts amount to 5.6%, nitrates and chlorides, accounting for the bulk of the salts.

Before proceeding to discuss the results of laboratorv examination of the soils it would be useful to review briefly the literature on fruit soils.

Chief among the characteristics desirable in orchard soils are good depth and texture providing for extensive root development and the maintenance of continuously favourable moisture conditions in the soil, freedom from hardpan or impervious strata and good aeration and drainage and freedom from soil alkali and salts.

Texture: The texture of the soil is an important consideration as it determines largely the drainage. The soil must have sufficient body to retain water but it must at the same time drain off the surplus. Sandy soils which are apt to dry out too quickly and lack the essential plant food elements and heavy soils are in general, not suitable. The ideal fruit soil is a light loam of good depth, varying but slightly in the first four feet and well-drained (7).

Although the texture is an important consideration it is impossible to attempt a definition of the soil requirements of fruit trees in terms of mechanical analysis. Experience shows that most fruit trees are not particular as to soil type and are found to thrive on a wide variety of soils, ranging in texture from sands to heavy loams. It is interesting to note that the soils of the Florida coast, famous for pineapples contain 98% of sand. Although the ideal texture is a loam, sandy loams or even sands and heavy soils may be suitable for fruits where favourable moisture conditions are present and where the topography favours drainage (2).

Depth of soil: Most fruit trees have a comparatively deep root system. The extent and depth of the root system has an important bearing on the productiveness and length of life of the fruit

trees. The deeper the soil and the more suitable the texture, the greater the development of root system. The minimum depth of soil for most fruit trees is considered to be 5 ft. There are many instances known in which soils are favourable for fruits simply because of the extensive root development they allow rather than fertility or moisture-holding capacity (6).

Drainage: Fruit trees are very sensitive to poor drainage and cannot stand 'wet feet', Thorough æration and drainage are, therefore, very important. The soil must be free from hardpan or impervious strata and no ground water must be present in the surface four feet except shortly after heavy rain. (6). It was found by Oskamp that in New York fruit growing area, the limiting factor was drainage rather than soil fertility (7). The colour of the soil gives an excellent indication as to its suitability or otherwise for fruits. In the case of well-drained and ærated soils the colour is more or less uniform. If the drainage is defective characteristic mottlings are noticed in the deeper layers of soil (7, 8).

Moisture conditions in soil: Fruit trees require continuously favourable moisture conditions throughout the growing season. The moisture content of the soil, its amount and availability throughout the growing season has been found to be of greater importance than any other factor (10).

Importance of physical conditions: Broadly speaking the physical condition of the soil is more important for fruit production than its content of the essential plant food elements. The most favourable soils are not necessarily the most fertile soils (2, 10). A survey of orchard soils in Quebec has shown that a very productive soil for farm crops may not be quite suitable for fruits and conversely a comparatively poor soil in good physical condition may give excellent results with fruits when properly fertilized and managed. If the physical condition of the soil is favourable, a good growth of fruit trees is often secured out of all proportion to what would be obtained from farm crops on the same land (6). Differences in individual tree growth and productiveness are commonly noticed in orchards and these differences have frequently been traced to variations in such factors as texture, drainage etc. rather than plant food content (2). Wallace from an analysis of the soil and pomological data obtained for West Midland soils in England comes to the conclusion that striking correlations exist between soil conditions and tree growth and that the soil conditions associated with success or failure in fruit trees are

mainly physical in character (13). Thus special emphasis is laid on the physical characteristics of the soil — depth, texture, drainage and favourable moisture conditions.

Water soluble salts: Most fruit trees are injuriously affected by more than 0·2% of salts in the soil. According to Coit less than 0·1% is considered safe. Saline irrigation waters are also detrimental.

Fruit soils considered from the chemical standpoint: Fruit trees require for their growth and development large quantities of nitrogen and potash and only small amounts of phosphates (4, 12).

Nitrogen: In considering the manurial requirements of fruit trees nitrogen is easily the most important and perhaps the only element needed for the most orchard areas. Fertilizer experiments carried out in U. S A. and Europe have demonstrated that nitrogen in a readily available form is the only element of plant food that is uniformly a factor in the favourable responses when such are secured. Very high nitrogen content of the soil results in rank vegetative growth and decreased yields. Irrespective of the amount of nitrogen present, fruit trees have been found to thrive only when an adequate supply of organic matter is maintained in the soil (4).

Potash: The potash requirements of fruit trees are undoubtedly high and the importance of an adequate supply of potash for the nutrition of fruit trees is recognised. Most orchard soils, however, contain sufficient amounts of this element to make the application of it unnecessary and the use of potash is confined to more or less restricted areas where the deficiency is extreme. Nitrogenous manuring is ineffective or even harmful in the absence of adequate amounts of potash (11).

Phosphorus: The phosphorus requirements of fruit trees are quite low and on account of their deep-rooting habit fruit trees are able to obtain their requirements from the natural supplies in the soil. Fertilizer experiments have demonstrated that fruit trees are not directly benefited by the application of phosphates unless the deficiency is extreme (3).

Chemical analysis of soil: The chemical composition of soils as determined by the present methods of analysis does not afford an accurate guide as to their suitability for fruit growing. Soils that are unproductive from the point of view of ordinary farm crops are often found productive for fruits. Wallace (13) has shown that no correlation could be traced between the contents of plant food elements

in the soils and tree growth. Stewart has analysed the response to fertilizer applications of trees growing in soils of varying productivity and comes to the conclusion that the correlation between the fertility status of the soil as determined by soil analysis and the response to fertilizers is exceedingly slight or absent. In fact the least response to fertilization was found in the soil analysing the poorest of all and some of the largest responses were found in the case of the chemically richest soils. Thus the relationship between the chemical composition of the soils and their suitability for fruit-growing is very little understood (2).

Soil reaction and lime content: Most fruit trees are tolerant of a wide range of soil reaction and are not so sensitive as are many of the ordinary field crops. Surface soils varying in pH from 4·5 to 7·5 have been used and no definite correlation between good or bad growth and pH could be traced within this range (10). The bulk of experimental evidence points to the fact that fruit trees rarely respond to applications of lime. Wallace in his survey of the fruit soils of West Midlands found excellent tree growth both on soils containing natural reserves of calcium carbonate and on others showing lime requirements (13). Lime was considered essential for stone formation in stone fruits and was widely used for all kinds of fruit trees in the past. In view of the fact that fruit trees rarely respond to lime and excellent tree growth occurs even on somewhat acid soils, provided adequate amounts of potash are present regular or heavy applications of lime are considered unnecessary. (11).

Citrus, however, is considered to be calcicolous in nature and its lime requirements are high. Adequate potash may compensate for lime deficiency (9). In Florida the best quality citrus orchards are invariably found on soils with good reserves of calcium carbonate. In California the citrus soils all tend towards alkalinity. The best quality citrus in U. S. A. is grown on arid soils in Arizona. In Italy and Spain the citrus soils are of the *terra-rosa* type rich in lime and often calcareous. In Nagpur oranges are grown on rather heavy black soils rich in lime and underlaid with '*murrum*' (gravelly subsoil) which provides good drainage. The soils of the most important citrus growing areas are thus well supplied with lime and this is supposed to contribute to the success of the orchard (4).

Analysis of soils, and waters: In view of the requirements of fruit soils stated above the laboratory examination of the soil samples has been confined to the following: — (1) content of water-soluble-salts by the electrical conductivity method for all samples,

)2) Natural reserves of calcium carbonate (qualitative) for all samples, (3) Mechanical analysis by the International method for roughly half the number of samples, (4) Loss on ignition, nitrogen, lime, total potash and phosphoric acid, available potash and phosphoric acid and pH in 35 selected surface samples.

The location of the profile pits in the various areas is shown in maps 1 — 5. * The field observations and profile characteristics, the percentage of stones and gravel, the content of water-soluble salts and information regarding the natural reserves of calcium carbonate in the soils are given in Appendix I. The results of mechanical analysis are contained in Appendix II. These results relate to the 'fine earth' obtained after the removal of stones and gravel (particles greater than 2. mm. diameter) in the preparation of the soil sample for analsis. As will be seen from Appendix I, stones and gravel often form large proportions of the soil and to obtain a good picture of the physical conditions in the soil, the results of mechanical analysis must be read in conjunction with the precentage of stones in the sample. The results of chemical analysis and the pH values of the selected surface samples are set out in appendix III, while Appendix IV gives the results of analysis of the water samples.

The soils of the areas surveyed are, in general, characterised by an extremely low content of water-soluble salts. Exceptions are the black soil area near Ujjini (Kottur-Ujjini area), the area near Vakkileru in Rudravaram, the area round about Kanchipalli village (Giddalore-Diguvametta) which is definitely alkaline and sticky, and Balireddipallo in Kodur firka.

As regards lime status the soils from the Vontimitta and Giddalore areas are well provided with lime. The soils from Rudravaram and Kottur areas contain fair amounts while the Kodur soils are generally extremely poor in lime. Data regarding the number of soils tested and the number which showed effervescence on the addition of dilute acids are given below :

Area	No. of soils examined.	No. of soils showing effervescence.	No. of soils showing no effervescence
1. Kottur-Ujjini	60	22	38
2. Rudravaram	93	55	38
3. Giddalore-Diguvamitta	77	63	14
4. Vontimitta	70	53	17
5. Kodur	109	10	99

* The maps and appendices will be published in the next issue of the Journal.

The total lime content of some selected surface samples from the various areas surveyed is given in Appendix III.

As regards the content of the essential plant food elements, Vontimitta and Giddalore areas are very rich in potash. Except perhaps, the soils of Vontimitta, the soil samples examined have an extremely low content of phosphoric acid, both total and available. The soil from the cheeni garden area, Panyam is a very rich soil, containing as it does 0·12% of nitrogen, 0·55% of phosphoric acid, 0·98% of potash and 3·7% of lime.

The pH values of the soils generally range between 8 and 9, typical red soils showing lower values.

As regards the water samples the well waters from Rudravaram, Vontimitta and Kodur are very good while those from Kottur and Giddalore areas are of somewhat high salt content and of doubtful quality for the irrigation of fruit trees. It will be seen that some water samples from irrigation sources which will be of no use whatever as far as the areas surveyed are concerned have been collected. From Giddalore some water samples have been taken from bore wells which provide drinking water. Taking into account only the wells used for irrigation purposes and in the light of the information gathered during the survey regarding the quality of the water, the above conclusion seems to be justified.

Suitability of the sites for fruit cultivation: In the light of the information available with regard to soil and water conditions in the five sites surveyed, their suitability for fruit cultivation is discussed below:—

1. *Kottur-Ujjini.* In view of the fact that the soils over the greater portion of this area are comparatively shallow, the water table very low and the water brackish, this area is not considered suitable for fruits.

2. *Rudravaram.* The favourable features of this area with regard to the water table and good quality of water have already been referred to. In the stretches of red soil area extending along the foot of the hills near Rudravaram, the water table is neither too high nor too low and the conditions are quite favourable. Over the remaining portions of the area sufficiently deep soils for profitable fruit cultivation are met with. The water table is, however, somewhat high and this may adversely affect the life of the fruit

trees. Reference has already been made to the fact that a great impediment to the development of the area is the lack of adequate road communications.

Diguvametta–Giddalore. Except near Diguvametta where the soils are shallow, the soil conditions over the remaining portions of the area are favourable. The greatest drawback to the development of the area is lack of irrigation facilities, the water table being very low. The civic Association of Giddalore have sent up a memorial to the Collector of Kurnool, praying for irrigation facilities by improving Vemulakunta and by damming the Sagileru stream at Kattiralabanda. These improvements, if effected, will benefit only an area of about 300 acres and any large-scale development of the area will necessarily have to be dependent on the tapping of subsoil water supplies. About half-a-mile northwest of the level crossing between Diguvametta and Giddalore two new wells have been sunk recently. The water table was found to be 20-25 ft. in the rainy season and the quality of the water fairly good. The supply of water from the wells is reported, however to be poor, being just enough for 1-2 acres under vegetables and chillies. It is possible that if tube wells are sunk adequate supplies and better quality of water may be available. The development of the area is intimately bound up with the availability of adequate and good subsoil water and for deciding this question trial borings will be necessary. As things stand at present, any large-scale and economic development of the area for fruits does not appear to be feasible.

4. *Vontimitta.* Mention as already been made of the fact that there is considerable erosion in this area and that the stretches of good soil are nowhere extensive. There is therefore, very little prospect of any large-scale extension of the area under fruits. There are, however, small but quite appreciable areas of suitable soil in all the villages surveyed, especially in Nadimpalli, Cherlopalli, Kottapalli and Mantapampalli which can be brought under fruits. The area is characterized by a high water table and very good water.

5. *Kodur.* The most characteristic feature of this area is the occurrence of deep soils (more than 8 ft.) over the greater portion of the firka. The water-table is neither too high nor too low and the quality of water good. The drainage is also good. The conditions are, therefore, very favourable for considerable extension of the area under fruits. The waste land near Settigunta is not considered suitable as the soils are of poor depth and subsoil water very low.

Summary:

1. The salient features of the five sites with regard to soil, water and other conditions are given.

2. The literature on the subject of fruit soils has been briefly reviewed.

3. The results of the laboratory examination of the soil and water samples are discussed.

4. In the light of the above information the suitability of the various areas for fruit growing is discussed.

In conclusion the authors wish to accord their thanks to Sri P. D. Karunakar M. Sc (Rutgers), A. R. I. C., the Government Agricultural Chemist for the interest he took in the work and for helpful suggestions.

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ANNOUNCEMENT

The Ramasastrula-Munagala Prize, 1949

1. The prize will be awarded in July 1949.

2. The prize will be in the form of a Medal and will be awarded to the member of the Union who submits the best account of original research or enquiry, carried out by him on any agricultural science.

3. The subject matter shall not exceed in length twelve foolscap pages, type-written on one side.

4. Intending competitors should notify the Secretary of the Madras Agricultural Students' Union not later than the 1st June 1949 with a covering letter showing full name and address of the sender. The author's name should not be shown on the paper, but should be entered under a *nom-de-plume*.

5. Four type-written copies of the essay should be sent.

6. The name of the successful competitor will be announced and the prize awarded at the time of the Conference.

7. Paper or papers accepted will become the property of the Union and the Union reserves to itself the right of publishing all or any of the papers.

8. All reference in the paper to published books, reports or papers by other workers must be acknowledged.

9. Any further particulars may be obtained rrom the Secretary, the Madras Agricultural Students' Union, Lawley Road P. O., Coimbatore.

K. Meenakshisundaram,
Secretary.

Seed Pre-Treatment for Improving Germination in some Cultivated Plants

By

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Where there are no other known methods of propagation, propagation by seed is the rule in the case of many economic plants. In view of this feature, the study of the several aspects of seed germination begun with the dawn of the present century continues with an unabated interest. Valuable evidence has accumulated on several factors relating to germination viz., temperature, light, moisture etc. Interest in such problems as those of seed viability and light sensitivity led several workers to study the light and temperature relations of germination. Haberlandt (1875) was the pioneer to study over 70 agricultural plants and found that the optimum temperature and germination requirements of seeds varied considerably. He then correlated the time relations of germination with temperature and light sensitivity of seeds.

In subsequent years, it was found that dormancy and after-ripening of seed present a new set of problems in the study of seed germination. Dormancy and impermeability mostly associated with hard coated seeds acting as barriers in their germination have handicapped their rapid spread even when favourable conditions existed. It is known that dormancy in seeds is due to one or a combination of several factors, viz. impermeability of seed coat, mechanical resistance of the seed coat, impermeability to oxygen, immature embryo etc. Several methods in the past have been tried by investigators to overcome these barriers. The treatments that have been commonly used to hasten germination and overcome impermeability in hard coated seeds are scarification, dry-heat, freezing and thawing treatment with chemicals, placing under conditions favourable to after-ripening etc.

Among these, scarification or wearing down the hard seed coat is the common pre-treatment widely adopted. Rose (1915) found that hard-coated seeds of legume, *Hibiscus esculentus* and mustard could be made to germinate by being blown against needle points. In some seeds scarification is reported by Wolfe and Kipps (1926) to reduce their longevity.

Among chemicals, carbon-di-sulphide, ether, ethylene-di-chloride, sulphuric acid, etc., have been recommended to overcome low germination of impervious seeds by the softening of the seed coat. Jones (1928) found

that the seed coats of *Nelumbo lutea* require a five hour treatment with sulphuric acid for facilitating their germination. Brown (1933) has reported that de-linting cotton seeds with sulphuric acid gives an increased rate of germination and 20 per cent increase in yield over the controls. Vapours of ethylene chlor-hydrin have been used to stimulate germination in hard-coated maple, oats, etc., by Deuber (1931) and Bramble (1932). A few other hormones have also been successfully tried by Mc Rostie and Hopkins (1938), Templeman (1939), Gracinin (1928) and others.

Certain physical means have also been effectively used by several investigators to induce germination in hard-coated seeds. Anderson (1931) obtained very high germination with seeds kept in darkness in dilute nitric acid. Germination in monkey flower *Mimulus ringens* was found by Hutchings (1932) roughly proportional to the intensity of light. Similar light sensitivity of seeds in germination has been brought out by Thornton (1936), Thompson (1935) and Flint (1934). Liquid air, partial pressure, alternation of temperature are other physical means that have been adopted by Bussee (1930) Harringron (1916), Midgeley (1926), Stewart (1926) Flemion (1931), Fivaz (1931), Moringa (1926) and a host of others to induce permeability in lucerne, celery, parsnip, flax, Bermuda grass etc. But certain abnormalities have been noticed by Busse and Burham (1093) in the use of the above treatments.

The literature on temperature relations of seed germination by Edwards (1932) gives a critical review of the optimal temparature relations and their significance in seed germination. Tang (1931) found that wheat seeds in general gave higher percentage of germination with higher tempe-ratures, after which at still higher degrees lower germinations was recorded. Livingston and Haasis (1933), Barton (1932) Robbin and Petch (1932) are a few of the investigators who fixed up certain optimum temperatures for seed germination ranging between 30 to 25° C.

Most of the methods suggested by the above investigators stipulate the use of some complex technique and costly equipment. These are not possible for easy adoption on a popular scale, on account of the cost and lack of scientific knowledge about treatments. In order to overcome these drawbacks certain standard seed testing and germinating plants and other skilled establishments have been set up in foreign countries

Initially a few of the above methods were employed to overcome im-permeability and laboratory trials were underway with several hard-coated seeds of economic plants which are known to be poor germinators. Mainly heat by means of water at various temperatures was applied by steeping seeds for limited intervals of time generally not exceeding five minutes and the encouraging results obtained in their germination are described in this article.

1. *Lucaena glauca* (*Nagarikesari*). This is a small tree belonging to *Mimosoidae* having very wide distribution in this province. Its quick growth and response to pruning have made it suitable as a green leaf manure plant for paddy.

The seeds are dark brown and possess a shining hard testa or seed coat. They germinate very slowly and generally the germination does not exceed 20 per cent. After pre-treatment with hot water for five minutes at different temperatures the following germination was secured in repeated trials.

Temperature :	30°C	40°C	50°C	60°C	70°C	80°C	90°C	100°C
Mean germination per cent	24	30	37	56	78	74	3	...

Temperature between 70 to 80°C is found to cause the seed coat swell and facilitate over 70 per cent germination. Immersion for longer intervals does not induce further permeability to any appreciable degree and at higher temperatures the embryo is devitalized.

2. *Tephrosia purpurea : Wild Indigo or Kolingi or Vempali.* This is a green manure plant generally sown immediately after the harvest of paddy. The seeds are small, mottled, hard coated and are poor germinators. Realising this, Chandrasekhara Iyer (1940) has suggested sand papering for scarifying these seeds. Pounding the seeds with sand is also commonly advocated. By steeping these seeds directly in hot water at 90°C for five minutes, over 65 per cent germination has been secured within two days of the treatment, as against 10 — 15 per cent obtained with untreated seeds. The germination secured at different temperatures for the same interval of time is as follows.

Temperature : ...	70°C	80°C	90°C	100°C	Untreated
Mean germination per cent	51	41	74	45	13

Scarification by sand papering or pounding with sand have certain limitations. Steeping in hot water is feasible on a bulk scale and uniformity of treatment with minimum effort and labour merit this as a better treatment compared with the other methods. Where quick germination is needed through economic and feasible means on a large scale to utilize the rapidly decreasing moisture after the harvest of paddy, this method lends itself admirably in forcing maximum germination in a very short time.

3. *Crotalaria juncea* sunnhemp. This is one of the quickest growing green manure crops widely used for several agricultural crops all over the province. The seeds are kidney shaped, purple to dark brown

in colour and possess a shining coat of moderate thickness. Pre-treatment with hot water at 70°C for five minutes before sowing has given as much as even cent percent germination within a day as against 80 to 90 percent obtained with untreated ones.

The germination obtained at different temperatures for the same interval of time within 24 hours is as follows.

Temperature ...	70°C	80°C	90°C	100°C	Untreated
Mean germination per cent	96	86	81	4	84

To force almost cent percent germination without any deleterious effects in a single day, pre-treatment with hot water at 73°C for five minutes is an economic and feasible method to ensure maximum germination. Through such quick germination achieved by pre-treating the seed, the seedlings are enabled to establish immediately with the available moisture which rapidly decreases after crop harvets or under dry or rainfed conditions.

4. *Prosopis juliflora* (Mesquite). This is an introduced quick growing plant which possess the desirable qualities of a hedge. Its quick growth, response to drastic pruning, thorny nature and bitter taste of leaves enabling it to ward off the ravages of goats and cattle and rank it as one of the best hedge plants suited to our conditions, though exotic in origin. Its propagation has presented serious difficulties both on account of its hard coated seeds and the leathery nature of the fruit impeding rapid seed extraction.

The pods are spongy with thick juicy pericarp. This can be softened by treatment with 1 : 4 sulphuric acid added just to wet the seeds and after 15 minutes the acid is diluted with enough water to cover or soak the pods completely and this is left to stand overnight. During this interval the acid corrodes and softens the pericarp without injuring the seeds enclosed in it. In one drying, the pounding is facilitated and the seeds are easily extracted. It has been found that the acid treatment is absolutely harmless and not inhibiting germination and at the same time costing not more than one anna per lb.

Direct pre-treatment of the seeds with hot water is not effective as scarification. Nambiar (1944) has stated that germination could be highly improved by shaking the seeds with sand in metal containers. About 65 per cent germination can be secured by this method within three days as against 10 — 15 per cent obtained without pre-treatment. Seeds scarified with sand when treated with hot water at 70°C for five

minutes give generally ten per cent higher germination than that secured with mere scarification. Within three days it is thus possible to secure over 75 percent germination by adopting the above two methods.

5. *Delonix regia* (*Gul Mohr*). This is an avenue tree found all over the province. The seeds are cylindrical, long, hard and tapering at ends. Treatment of these seeds in hot water for five minutes at varying temperatures gave the following germination within a fortnight.

Temperature ...	60°C	70°C	80°C	85°C	90°C	100°C	Untreated
Mean germination per cent	37	48	69	75	44	49	24

Direct steeping in hot water between 80 to 85°C gives about three times higher germination than that of untreated seeds within a fortnight. The testa or seed coat wears down into thin wavy films and facilitates the absorption of water and the quick germination of the embryo.

6. *Delonix elata.* This is an avenue tree found largely in the several regions of this province resembling almost *Delonix regia* and popularly known as Chittikeswari in Telugu. The seeds are flat, hard and possess dull metallic lusture. With similiar pre-treatment in hot water for five minutes at varying temperatures the germination obtained is tabulated below.

Temperature ...	60°	70°	80°	90°	100°C	Untreated
Mean germination per cent	36	44	68	84	49	40

Within a fortnight, germination about twice that of the untreated seeds could be secured by directly steeping the seeds in water at 90°C for five minutes.

7. *Phyllanthus emblica* (Indian Gooseberry). This is an useful plant found scattered all over this province. The fruits are reputed to be the richest source of Vitamin C. The seeds are hard, angular, and brown in colour and are poor germinators. The seeds are extracted by drying the fruits in sun light for some days, when the carpels dehisce and liberate the enclosed seeds. The seeds require about two months storage after harvest for 'after ripening'. Attempts to induce germination in this period failed to achieve any success. Subsequently treatment of the seeds with hot water between 75 to 85°C for five minutes, over 80 percent germination was secured within ten days as against about 25 percent obtained with untreated seeds. The seeds vary very highly in their capacity to germinate and prior steeping in cold water is necessary to reject immature and sterile ones that float.

8. ***Mimusops hexandra*** (Pala). This is an evergreen wild fruit plant. The seedlings are used as a rootstock for sapota (*Achras sapota*) and the fruits are edible. The seeds vary in size and colour and the cotyledons are enclosed in a hollow thick seed coat. The seeds require over a month's 'after ripening' after extraction. Split seeds showed over ten percent germination although 15 percent were damaged in spliting the seeds with a wooden hammer. Steeping the seeds in water for five minutes at 80°C induce about 10 per cent germination within a fortnight as against one or two per cent obtained with untreated seeds.

9. ***Zizyphus jujuba*** (Ber). This is a hardy fruit plant found scattered all over the province and requires very little attention in its maintenance. Select and choice plants are generally propagated by budding on seedlings. The fruits are round and the endocarp enclosing the seeds exceeds one fourth inch in thickness. They do not give more that 2 per cent germination even after two months. The seeds are extracted by breaking the stony coat or endocarp with an iron hammer against a hard surface. About 30 per cent damage or loss is inevitable even with careful extraction. The extracted naked seeds when soaked in water at varying temperatures, the following germination was obtained within a month.

Temperature ...	60°	70°	80°	90°	100°C	Untreated
Mean germination per cent	6	39	9	3	...	2

Pre-treatment of the extracted seeds with hot water at 70°C for five minutes gives a high percentage of germination as against a meagre percentage obtained with the hard stony coat in tact.

10. ***Medicago sativa*** (Lucerne). This is widely used in all countries as a fodder crop and is generally fed to horses and milch cows. The seeds are minute, reniform and fairly hard coated. Midgely (1926) has reported that these seeds germinate better when kept in moist condition for several months. Several other methods have also been suggested by other investigators to overcome impermeability in lucerne.

By steeping the seeds in warm water at 50°C for five minutes, over 50 per cent germination can be secured within four days as against 30 — 40 per cent obtained with untreated seeds. At higher temperatures germination is inhibited and the embryo does not withstand the heat.

Summary and Conclusions

Seeds of some economic plants subjected to heat pre-treatments at varying temperatures for an interval not exceeding 5 minutes, give different response in germination; in all cases the treated seeds showing greater germination per cent than the untreated ones.

The table below gives the summery of performances of the economic plants tried here.

Name of plant.	Temperature of water in C.	Time of treatment	Mean germination per cent		Period or Interval.
			Treated	Untreated	
		Minutes.			
1. Lucaena glauca	70	5	78	24	10 days
2. Tephrosia purpurea	90	5	70	13	2 ,,
3. Crotolaria juncea (Sunnhemp)	70	5	96	14	24 Hours
4. Prosopis juliflora (after shaking with sand)	70	5	78	12	3 Days.
5. Delonix regia	85	5	75	24	14 Days
6. Delonix elata	90	2	40	14	14 ,,
7. Mimusops hexandra (Pala)	80	5	10	14	14 ,,
8. Phyllanthus emblica (Indian Gooseberry)	80	5	82	20	10 ,,
9. Zizyphus jujuba (with naked seeds)	70	5	39	2	30 ,,
10. Medicago sativa (Lucerne)	50	5	52	35	4 ,,

II. Optimum germination is obtained with treatment for five minutes in water ranging between 70 to 80° C in many of the plants reported here.

III. At higher temperature over 80° C, only wild indigo and *Delonix elata* have shown better response in germination than at lower temperatures indicating that the thicker the seed coat, the higher is the temperature required to induce maximum permeability.

IV. Still higher temperatures between 90 to 100 C, or at boiling point of water, the seed coat looses its resistance and in many seeds very poor germination has been recorded; this temperature being detrimental to the vitality of the embryo.

V. Temperatures between 50 to 70° C though induce better germination than the control are not sufficient to induce maximum permeability.

VI. Heat pre-treatment through water induces the seed coat to swell and causes permeability and promotes the development of the embryo. Simultaneously it facilitates the penetration of the radicle through the softened seed coat.

VII. In some hard coated seeds, heat treatment by itself fails to induce permeability but accelerates the pace of germination after scarification. In *Prosopis juliflora* prior scarification is necessary by grinding with sand and further treatment with hot water increases the pace of germination. In *Zizyphus jujuba* and *Mimusops hexandra* intermediate fruit coats are stony and do not allow moisture or the expansion of the embryo. The breaklng of this coat is necessary prior to heat treatment to allow the ingress of water and the development of the embryo.

From the foregoing, it is clear that heat through water at varying temperatures is a feasible means of inducing permeability in hard-coated seeds of some economic plants. Otherwise, in these seeds germination fails to occur normally till water penetrates in to the seed coat. The pace of germination is generally quickened with the breaking of the dormancy and impermeability induced by heat. Seed permeability in several other hard coated seeds not tried so far is also likely to be facilitated by such pre-treatment resulting in quicker and higher germination. Depending upon the thickness of the seed coat, the harder the seed coat, the higher is the temperature required for inducing permeability. In still harder seed coats, breaking of the fruit coat or other structure which acts as a barrier is needed. Optimum permeability without any deleterious effects on the embryo is generally secured with five minutes treatment irrespective of the range of temperature. At higher temperatures beyond 80° C, generally treatment for periods longer than five minutes has been found to be definitely deterimental to the embryo. At temperature below 80° C, treating the seeds beyond five minutes period does not induce appreciably higher permeability or greater germination. This has been already indicated by the author with *Lucaena glauca* (1948). The emergence of the radicle penetrating the seed coat, has been taken as the sign of germination. In field trials, longer periods are required as the seedling is seen only when the germination phase is nearing its end.

Wherever there was low germination at temperatures over 80° C, in general, it was observed that the embryoes are devitalised or killed due to heat shock and in many cases at 100° C, or boiling point of water, most of the seeds get cooked. Proper care and adequate caution are therefore required in observing the temperature and in adhering to the limits specified which generally does not exceed 5 minutes for securing maximum germination without any untoward effects. The seedlings from heat treated seeds were found in all cases coming up like the normal plants and injurious effects if any resulting in the death of the embryo or intermediary effects as set back in growth or wilting of the seedling are not seen.

At present there is universal shortage of all commodities. Seeds are priced high and are not available in adequate quantities especially when a drive for more planting and increased food production is a-head. It is felt that by adopting the above methods, more plants

can be secured in a very short time out of the available and wastage in seed can be eleminated through such an exploitation. In the case of green manure crops which are generally sown after crop harvests or as intercrops under rainfed conditions, utilisation of the rapidly decreasing moisture in the soil, is an essential requisite for successful crop production. The above methods of seed pretreatment remove the erstwhile handicaps and facilitate in the case of green manure crops like Sunnhemp and Wild Indigo maximum germination in as short an interval as possible and the successful establishment of the plants before the moisture dries off. It is hoped on account of the simplicity, and feasibility, the above methods will be widely adopted by the agriculturists.

Acknowledgement.

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Varieties and Propagation Methods of Sweet-Potatoes in South India.

By

S. N. CHANDRASEKHARAN & D. DANIEL SUNDARARAJ

The species *Ipomoea batatas* Poir is known nowhere in a wild state. The cultivated form is derived from an allied species, *I. fastigiata* Choisy which is believed to have originated in West-Indies and Tropical America. The plant, being well suited for tropical countries, is extensively cultivated in the tropics of both the hemispheres. It is not adapted for cool climates and seldom thrives well over altitudes of 3,000 ft. The crop requires a warm moist climate in the planting and growing season and a dry sunny weather at harvesting time. Sweet-potato are grown only in one season in the Southern districts of Madras i, e., from September—October to February—April. In the Circars and Agency tracts it has generally two seasons, June to September—October and September—October to February—March. A similar practice exists in Malabar and parts of South Kanara.

Botanical description: *Ipomoea batatas* Poir, belongs to the family *Convolvulaceae* and is a perennial by habit, though it is treated as an annual in crop practice. It is a weak-stemmed, twining or trailing herb; leaves alternate, exstipulate, varying in shape but often ovate to orbicular in outline, cordate or truncate at the base, entire, shouldered, digitately lobed, or deeply cleft. Flowers axillary, cymose or solitary borne on short peduncles; calyx 5-parted, greenish imbricate, about half-an-inch long and persistent; corolla gamopetalous, funnel-shaped, 1½ to 2 inches long by 1 to 1½ inches wide at the mouth and light purple in colour; ovary superior, bicarpellate, 2 to 4 celled, 4-ovuled; fruit a capsule; seeds small slightly flattened and black. The adventitious roots are modified into tubers which store reserve food material.

Varieties: Though *Ipomoea batatas* flowers quite freely under South Indian conditions, it does not often set fruits and seeds. The non-setting of seeds is ascribed to the self-sterility of the flowers and this has made the breeding of new varieties a difficult task. But recently, by control treatments they have been induced to bloom and set viable seeds (3). It is also recorded that when two or more varieties are grown side by side they occasionally set seeds; in Japan by artificial cross-fertilization the setting has been increased from 16·3 to 58·1 per cent (5). The absence of free crossing and non-setting of seeds are mainly responsible for the limited number of varieties met with in *Ipomoea batatas.* Many present-day sweet potato varieties have originated as a result of bud mutations which take place rather freely in this species (2, 4).

There are about ten varieties that are commonly cultivated in Tropical America and among them many types have been recognised. Though the different varieties are classified commercially as the "dry" and "yam" types depending on the texture of the flesh of the tuber, there is no definite satisfactory classification based on morphological characters.

In South India there are two distinct varieties distinguished by the colour of the skin of the tubers—one with white skin and another with reddish skin. In both the varieties the pulp is white. The red variety which is supposed to be the earlier introduction of the two, is a hardier plant with robust vines, forming smaller tubers. The duration of the variety is shorter and the yield is also less than that of the white variety which forms bigger tubers. The tubers of the latter are more uniform in shape and a little more fibrous than the red variety and has a better keeping quality. In the red variety there is a form with light red or pink colour which is cultivated to a small extent in the Circars. The white variety on the East-coast and Central Districts is of one type without any variation, whereas four forms have been met with in this variety on the West-Coast districts. Though a variety with yellow pulp is said to be existing, it has nowhere been found so far. The following varieties and forms are cultivated by the ryots in the centres noted below :

	Centre	*Variety and forms*	*Distinguishing leaf characters*
I.	Coimbatore and Southern districts	Red variety	Leaves entire or with slight shoulders and without any pink colour on veins.
		White variety	Leaves prominently shouldered when young and often lobed in mature plants with pink markings on veins.
II.	West Coast districts	Red variety	Similar to the red variety in the other area.
		White variety Form I	Leaves lobed and often cut into five lobes; pink colour markings on veins; similar to the common white variety found in centre I. Known as 'mathras' around Kasaragode.
		Form II	Leaves deeply lobed into seven; rest similar to form I.

Centre	Variety and forms	Distinguishing leaf characters
	Form III	Leaves more or less entire with or without shoulders and without any pink colour on veins. Plant resembles red variety.
	Form IV	Similar to form III but with pink colour markings on veins. Locally known as 'nadan' around Kasaragode.
III. Vizianagaram	Red variety	Leaves more or less entire, with or without shoulders and with purple colour markings on veins.
	Light Red or Pink	Leaves shouldered; with light purple colour markings on veins locally known as 'kosta'.
	White variety	Leaves shouldered or lobed but without any colour markings on veins.

Propagation Methods: The propagation of *Ipomoea batatas* is mainly by vegetative means with cuttings taken from the vines. There are two ways by which the seed material or vine cuttings are prepared for planting in the regular season. The common method is to raise small plots of nurseries with cuttings got at the time of harvest. The vines from the first small nursery are again multiplied in a second bigger nursery after two or three months. In another two to three months the second nursery gives planting material for 15 to 20 times the area occupied by it.

In the second method, instead of planting the vine cuttings small unsaleable tubers are planted in the nursery. These tubers produce a number of shoots which arise from the axils of the lateral roots of the tubers in about 7 to 10 days after planting. The meristematic cells situated at the base of the fibrous lateral roots develop into shoots under favourable conditions. The small sprouts may be easily pulled out and transplanted in the field as is done in many parts of America (1). In South India wherever the nursery is raised from the tubers, the sprouts are allowed to develop into vines from which cuttings are obtained for the main crop.

After rejecting the mature bottoms, cuttings of 9 to 12 inches long with 3 to 4 nodes are usually taken from the vines. Longer cuttings than 12 inches produce very small tubers as a number of nodes get confined to a smaller area and thus retard tuber development. The vine cuttings can be safely stored in gunny bags without deterioration of viability for 2 to 4 days. The leaves are usually removed from the cuttings and it is a matter of natural response that such cuttings produce new growth more quickly than the cuttings with leaves. The cutting is capable of rooting at all the nodes that come into contact with the soil; the buds at the axils of each leaf develop into shoots. When the tender apical cuttings are planted the terminal bud unfolds the younger leaves and puts forth vigorous growth without drying up.

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HINTS TO FARMERS

FRUITS

Selection of sites and soils for fruit-growing.

1. A soil that is at least 6 feet deep, is uniformly textured up to that depth, possesses perfect drainage, and has a water table about 6 feet below the surface in any period of the year, is considered ideal for fruit-growing.

2. Variation in soil texture within the first 6 feet of soil will lead to ununiform root distribution and development or may lead to unnecessary loss of moisture and plant foods. Drainage may also be imperfect on such soils.

3. A soil of the moderately open texture as a loam is preferable to open sandy soils or to stiff clayey soils.

4. Mere judging of soils by observing the surface is definitely misleading and most risky. In most cases a good surface soil may have a few inches below sheets of rock or impenetrable layers of kunker, stone or boulders, which will not permit roots to grow.

5. Soils varying in texture up to six feet depth within small distances are common, and these are not ideal for fruit growing.

6. All soils suspected of alkalinity or salinity or have to be irrigated with water which is not sweet, should be chosen only after the advice and opinion of a competent chemist are obtained.

7. Water table, which rises even on rare occasions, such as on an exceptionally heavy rainy period, to within 6 feet from the surface, will render the site risky for fruit culture.

Irrigation in Orchards.

1. Irrespective of the soil and the fruit, irrigation is dependent on the rainfall and its distribution. Irrigation has to necessarily therefore be based on a careful consideration of the soil moisture as influenced by the rains; that is to say water should be applied only when soil moisture is deficient and trees show first signs of distress.

2. Under a given set of conditions, a light, open or sandy soil requires more frequent watering than other soils. Even so, shallow soils require more frequent applications of smaller amounts of water than deep soils.

3. When intercrops are grown, the tree requirements should be considered as supreme. It is therefore necessary to select intercrops, that would not conflict in water needs with the fruit.

4. The differential needs should be known. For instance, a crop like banana can stand and even welcome more frequent and larger applications of water than citrus trees.

Correspondence

I

Sir,

In the "Madras Mail" of about 9—2—1949 there is some news on rain making in Australia.

In about 1912 or thereabout, one Narasimmal Naidu (of a printing press, in C. B. T. R.), explained at Peelamedu the same thing, that is, a similar explanation was given for Rain Making.

A cold fluid, ice or water at 1 to 4 degrees centigrade is sprayed in the clouds and a 4 inch rain was got in Australia.

Instead of spending a 1000 crores of rupees for hugo tanks, one rain of some 4 inches can be got by spending a 100 or 50 rupees. for hiring an air plane and sprayiug some cold fluid.

I beg at least the Agricultural Department can try this experiment.

Avarampalayam,
Ganapathi P. O.,
Coimbatore.

Yours cordially,

A. P. KRISHNASWAMI.

II

Sir,

I have read carefully the article in your December issue — "The Economic Price of Paddy" by Sri Chidambaram Pillai, M. A., It is a pity that an article dealing with such an important question has been published without any editorial comment for I feel more muddled than ever, after reading it.

The gist of it is obviously that the price for procurement fixed by government is uneconomic and in support are given figures which have every appearance of careful and learned accounting. But they fail to convince me of anything, except that there is something wrong some where. May I put before you the main points which have intrigued me?

Firstly the value of the land is put at Rs. 6000/- an acre and so Rs. 270/- is added to the cost of production. Either, (a) this value has no relation at all to the productive capacity of the land and is simply an arbitrarily inflated figure; or (b) the land is so fertile as to be worth the value placed on (or paid for) it. If (a) is right, then the first thing to do to convert a loss into a profit is to place a correct value on the land and reduce the Rs. 270/- to some more reasonable figure and there you are with a nice profit in your pockets.

If on the other hand, the land is really worth the value put on it judging by its productive capacity, then:—

1. The ceiling price fixed is uneconomic because the cultivation is inefficient, or

2. the costing should be revised, or
3. the ceiling price should be increased.

The world position in regard to food is such — if we are to believe the frequent statements made by Sir John Boyd Orr — that land should no more be entrusted to an inefficient cultivator than you would entrust your Aeroplane to an inefficient mechanic. Tinnevelly is the only district in the province in which I have never set foot and so I know nothing about the efficiency of the Tinnevelly ryots. On the other hand, there are certain other figures in Sri Chidambaram pillai's statement which intrigued me.

Why the annual recurring item of Rs. 15/- for permanent improvements on land valued at Rs. 6,000/- per acre? Does gold require gilding? Why use 140 lbs. of seed per acre in such fertile lands? Even we use no more than 90 lbs. on our sands. Why pay Rs. 24/- in 1948 for 140 lbs. of seed when the agricultural Department supplied me with seed at 2 as. per pound?

Again, apparently, the straw which is breaking the Tinnevelly camel's back is iniquitous land tax of Rs. 28/- per acre. I have to pay Rupee one per acre which I bought in 1944 for Rs. 60/-, whereas, land worth Rs. 6,000/- per acre is taxed Rs. 28/-. Calculating on an 'Ad Valorem' basis I am paying a tax of Rs. 100/- while Sri Chidambaram Pillai pays only Rs. 28/- on a capital of Rs. 6,000/-. This reminds me of the story of an American which I read the other day. He visited a circus where he saw a camel. He picked up a straw and placed it on the camel's back. As nothing happened he was noticed walking away shaking his head and muttering "wrong straw".

But let me cut the story to save this trouble Mr. Editor. So just one final point. Mr. Pillai pays only Rs. 1/8/- for a cart-load of cattle manure. Owing to the paucity of cattle and their miniature size and to the serious competition for the little cattle manure available from growers of native (chewing) tobacco, we have to pay anything from Rs. 20/- to Rs. 25/- per cart-load. Yet in what was barren sand four years ago I am now finding that even the 1947 price is not at all uneconomic while the 1948 price recently fixed (i. e. from 1st November 1949) leaves a nice little profit for me.

Sir Albert Howard said 'The Arsenal of Democracy is fertile soil'. It is dangerous to entrust an Arsenal to inefficient users.

Y. R. Farm,
Nileshwar,
March 8, 1949.

Yours truly,

R. M. SAVUR.

Agricultural News Letter

January, 1949.

Manuring and Irrigation. On the black clayey soils of the Bellary District, Sorghum (*Cholam* or *Jonna* or *Jowar*) and cotton are the main crops that are grown. In the rain fed conditions, the normal acre yields have been 450 lbs. of sorghum. By irrigation alone, the yield was increased to about 900 lbs. but when irrigation was combined with adequate manuring, the results were still better. Sorghum, manured at 60 lbs. nitrogen per acre, and irrigated, gave an acre yield of 2,244 lbs. of grain and cotton, manured at 80 lbs. nitrogen, gave a return of 672 lbs. per acre of unginned cotton. Further work is in progress. The indications are that where crops are irrigated, there is need to manure the land as well, in order to get the full worth of irrigation.

Summer Paddy Crop. The majority of paddy grown in this province is after summer, when water supplies are assured after the monsoon rains. But to a small extent paddy is grown in the season known as Kar and also in the season Kuruvai. In tracts, where the percentage of the area of Kar or Kuruvai crop could be large, the yield of paddy is also high. In this season, the following have been some of the outstanding yield records obtained from the harvest in September last. The paddy strains, known as Ambasamudram 1, 2 and 7, have recorded yields of 3550, 3310 and 3610 lbs. per acre. The strain ADT. 3 has given an acre yield of 3300 lbs. which may be said to be the record so far at the Pattukottai Station. Therefore, one of the means to enhance the yields of paddy in this province would be to increase the area that could be grown with either Kar or Kuruvai paddy varieties.

Thaladi Paddy crops. In very many fields, the standing young Thaladi crop, especially those transplanted late in the season, remains stunted in growth and some cultivators are of the view that it is due to "Soorai" caused by meal bugs. But a closer examination would reveal that the central shoots of the infested plants or tillers are dried up, which is due to the attack of the paddy stem borer. A top dressing of Ammonium sulphate at the rate of about 100 lb. per acre would considerably improve the situation. Fortunately, one or two tillers invariably survive in each clump, even after a severe infestation of the pest and such surviving plants could be invigorated to tiller profusely by the application of ammonium sulphate. No time should, however, be lost hereafter for the application of the fertilizer. As the borer moths are attracted in large numbers to bright light at night, light traps would prove to be a useful remedial weapon, if all the ryots of a locality would adopt it in their common interest. Moths are attracted to light in larger numbers during dark nights than during moon-light nights. Local Agricultural Demonstrators may be consulted if necessary, for the setting up of the light traps.

Attack of Thrips, A timely spraying of the affected nurseries of Samba and Thaladi paddy with tobacco decoction, accompanied by a dressing of ammonium sulphate at 100 lb. per acre, considerably helps to put down the attack of thrips. The cost of spraying a 10 cent nursery which will plant an acre, will be Rs. 1—8—0.

Piricularia. From the variety of paddy known as Mologolukulu two cultures No. 2555 and No. 2202 have been found to be highly resistant to the blast disease known in Telugu as "Medavirupu" and in Tamil as "Kollai Noi". These two cultures are suitable for the district of Nellore and for the adjoining areas. In 1947 - 48 when this disease was severe in Nellore, the two cultures displayed a very high resistance to the disease and yielded 20 to 40 per cent over the local variety of Mologolukulu. They have been named BCP. 1 and BCP. 2 respectively and are being multiplied in an area of about 10,000 acres in this season. The farmers of the Nellore district hereafter need not suffer any loss by the incidence of the fungus, Piricularia, on paddy.

Sweet Lupin. A substitute for red gram, which will come up in higher elevations and milder climate, is under cultivation at the Agricultural Research Station, Nanjanad. This is known as "Sweet lupin" (Lupinu angustifolius). It is a 7 month crop that is sown in April and harvested in October and November for seed purposes. The seeds can be used in the place of peas, while green, and in place of dhal, when dry. It can also replace horse gram for cattle feed. This is a suitable green manure crop for hills and produces remarkably large nodules of nitrogen fixing bacteria, which enrich the soil. A green manure crop sown with 100 lb. seed per acre would give 10,000 lb. of green material as manure, when harvested prior to the flowering stage. It is a boon to Nilgiris district where the soil is poor in plant food and organic matter, so essential to support good plant growth. Small quantities of seeds of this dual purpose crop can be obtained from the Superintendent, Agricultural Research Station, Nanjanad.

Karunganni Cotton. By way of further improvement over the earlier strain, a new one called "K. 2 cotton" which is vigorous and quick growing, has been evolved for general distribution. It gives 15 per cent more yield than the local mixture and about 3 per cent over the earlier strain K. 1. K. 2 is able to withstand the ill effects of untimely rains in January and February, which cause heavy shedding of flowers and immature bolls. K. 2 bears big bolls which open well, making it easy for quick and clean harvest; has a good staple length capable of spinning up to 28's standard warp counts. The strain would yield a higher income up to Rs. 20 per acre over the return of the local cotton. There is a scheme for the rapid multiplication and distribution of this improved cotton. Cotton growers of the Tinnevelly tract would do well to take full advantage of the scheme.

Sea Island Cotton. Sea Island cotton, grown by a farmer of Udipi in his backyard, was sown early in July 1947 in the Agricultural Research Stations at Pattambi and Taliparamba in Malabar and Nileshwar and Kankanadi in South Kanara District. Harvests were completed by October and November and the plants were ratooned in May 1948, leaving a stump of 9" from the ground. These ratooned plants put forth quick vigorous shoots, grew to a height of 2½' to 3½' and bore on an average of 25 bolls, yielding 2½ to 3½ ozs. of kapas per plant. The opening of bolls, was very satisfactory and the quality of cotton was fine, strong with a staple length of 1·56".

Harvest of Sugarcane. The determination of total solids in the sugarcane juice by a simple Brixometer, giving an index of sucrose per cent in the juice, can be done by any sugar cane grower. In the case of a variety like Co. 419, the maximum Brix's reading would vary from 20 to 22 per cent, depending on the season and soil conditions. If mature cane is to be tested by trial boiling of the cane juice, Co. 419 may be considered to be mature, when the recovery of the jaggery is 12 per cent of the cane weight. Ordinarily, the age of the crop would give reliable index of the maturity of the cane. Co. 419, which is largely cultivated in this province, would be mature, if harvested when it is 11½ months from the date of planting if the planting was between February and April; but in a crop planted in June, maturity is attained in 10½ months.

Plio Film. Plio film, a synthetic plastic product looking like glassine paper. affords proof against moisture and high permeability to carbon-di-oxide. Trial with this new wrapper has given very promising indications of assisting the fruits to remain in a better state of preservation than that left untreated i. e. for two to three weeks.

Education in Agriculture. In the re-organised scheme of secondary education, agriculture and gardening has been prescribed as one of the subjects for vocational courses of study from forms IV to VI. One of the schools that has adopted agriculture both as craft and as a vocational course of study is the Sivaswamy Iyer High Shcool, Tirukattupalli, Tanjore where about 40 pupils are taking instruction in agriculture. About 30 acres of poramboke was alienated by the Government and it was made fit for cropping by the school authorities, with the help of modern mechanical equipment. About 20 acres have been planted with paddy and 7 acres have been reserved for horticulture.

Campaign against Insects. Conservation of the enormous stock of food grains against the insect hordes has ceased to be a problem by a judicious use of Gammexane and D. D. T. dusts. In the field, Gammexane D. 025 literally decimates serious insect pests like grasshoppers on paddy and sugarcane, the rice bug, the cholam earhead bug, the sugarcane fly, flea beetles, termites and a host of other insects. D. D. T. appears to

have a more or less specific action against leaf eating grubs, termites and a variety of household and livestock pests. Two pounds of D. D. T. 550 wettable powder, mixed in 100 gallons of water, will be enough to spray an acre of paddy infested with paddy jassid. The annihilation of the pests sure in the course of three days and the cost works out at about Rs. 6/- per acre.

Sorghum Earhead Bug. The experience at the Agricultural Research Station, Siruguppa, shows that if D. D. T. wettable powder is mixed with water and sprayed at 1 per cent strength, with the help of an ex-A. R. P. stirrup pump fitted with a nostle, when the Sorghum crop is in the short blade stage, the ill-effects of the Sorghum earhead bug are got over.

Cattle Vaccination. The results of Brucellosis Vaccinations conducted during 1945 in a herd at Sethumadai of Coimbatore district were successful. The protected heifers had conceived and calved normally, and none of them aborted, fresh tests were made with 161 samples or sera from the same village of which 29 proved positive.

Immunity against Rinderpest. The Hon'ble Dr. S. Gurubatham Minister for Firka Development and Prohibition, inaugurated on December 12, 1948 at Penduriti, Vizagapatam district, a campaign of mass inoculation against rinderpest. The Hon'ble Minister personally inoculated the first pair of bullocks, which were brought there, for immunity against rinderpest.

February 1949.

Agricultural Prospects Brighter than ever. Several Agricultural problems of vital nature, that are likely to be faced, when the Tungabadra Project comes into operation, are being studied at the Irrigation Research Station, Siruguppa.

A good portion of the project area is made up of deep black soil and the tract, in general, receives low and uncertain rainfall.

It has now been established, that no harm will result to the black soil due to irrigation with Tungabadra river water by rise of harmful salts. It is also interesting to note that as a result of timely irrigation with adequate manuring, yields of crops appreciate many fold compared to yields of crops depending solely on the uncertain and untimely rainfall. Figures given below need no comment, and speak for themselves, as to the great potentiality of the famine areas of the Ceded District coming under the Project.

	Jonna (Sorghum) Grain	Straw	*Cotton* Kappas.
Rainfed ...	401	981	387
Irrigated ...	450	1387	367
Irrigated & manured ...	2244	7106	672 (SON)
Irrigated no-manure (60—N) ...	913	5300	290

An Improved Bunch Type of Groundnut in Sight. The popular bunch variety of groundnut extensively cultivated in the Guntur and the Pollachi areas of this Province has one great drawback. Rains during harvest result in a good portion of the nuts germinating in the field itself due to non-dormant habit and entail loss to growers and affect the quality of the produce. This problem has been under study by the Oilseed Specialist. The high yielding hybrid culture A. H. 6481 does germinate not even, if the weather is wet during harvest. It will soon go through large scale trial in the district before release for general distribution.

Setting in Plum Orchards Solved. At the Pomological Station, Coonoor setting of plum trees, Shiro, being a self infertile variety is usually very poor. It had unusually a good crop in 1948 for the first time. This is attributed to the fact that another new variety from Kotagiri planted in between the rows of Shiro four years back flowered for the first time. It is found that the new variety of plum inter-planted proved a good polliniser for Shiro. Grafts of the new variety are being multiplied for large scale distribution for inter-planting in gardens planted with Shiro and securing regularly a good crop of plums.

A Sceptic Fruit Nursery—Man Converted to the Correct method of Propagation of Fruit Plants. In 1944 a nursery man in Srirangam has been following the whip-cum-inarching method for securing mango graft on a large seale. It was suggested to him to either prefer inarching or alternatively the root stocks might be lopped 4″—6″ above the graft joints at the time of grafting. For the past two years, he had taken up the latter suggestion with profit and has been successfully raising hundreds of grafts, as it contributed to a high " take ".

An Improved Strain of " Budama " (Cucumis Trigondus) A-18 of Nandyal. In the Nandyal Valley of the Kurnool District, a vegetable locality known as BUDAMA (a variety belonging to the cucumber family) is a regular mixture, with Korra (Tenai, Setaria Italica) and Red Gram, in dry lands at the rate of half to one ounce of seed per acre. It matures in three months and an average of 500 lb. of ripe fruits are gathered per acre. It is usually cut out into chips and dehydrated in the sun for use as a vegetable during summer. A slection in this variety named A. 18 with eliptical fruits of scarlet yellow colour has been isolated for distribution.

Propagation of Jak Made Easy. Propagation of Jak through seed is not only a slow method, but the plants do not also turn to be true to the parental characters. Experiments at the Fruit Research Station, Kallar have shown that Jak could be easily propageted by grafting. It will therefore be a quick method of propagating on a large scale Jak varieties which are known to possess very desirable characters for yield, quality of fruit etc. The fruit section will be highly thankful to people who will communicate the location of such special varieties.

A Rare Type of Ragi. The grain of the finger millet (Ragi – ***Eleusine Coracana***) is brown in colour. A new type with white grain was discovered at the Millet Breeding Station, Coimbatore. It contains twice as much protein and 50% more vitamin than the brown ragi under cultivation. But as ill luck would have it, it is poor in yield. Research work is in progress at the Millets Breeding Station, Coimbatore through hybridisation to build up brown ragi rich in proteins and vitamin.

Measures to check rust Disease in Tenai. Rust is a serious disease that often attacks the Italian Millet. This is spotted out by the characteristic brown rusty spots on the leaves. In certain adverse seasons, the disease assumes an epidemic form and results in a severe loss to the farmers. Extensive survey of the varieties cultivated in various tracts of the Province was undertaken and a larger collection made. During the course of the intensive study of these materials, a type least susceptible to the disease and recording fairly high yield has been isolated. It is under yield test.

On the way to check striga - a root Parasite on Sorghum. Striga (Sudumali or Malli) is a flowering root parasite on many cereals. Sorghum is highly susceptible to it. The parasite attaches itself to the root of the Sorghum plants and sucks the nutrients going up to the formation of grains on tho ear head. It therefore results in a low yield. Sometimes the Sorghum plant dies when a number of striga plants attaches itself to the host.

An African type of Sorghum resistant to this pernicious parasite has been isolated at the Millets Breeding Station. But to our disappointment, the grain of the resistant type is unpalatable. So a programme of hybridisation between the resistant type and the local cholam varieties has been put into execution and selections combining the desirable qualities of the local varieties and the resistant character of the African type are being tested.

Glut in the fruit market and unsalable fruits need not worry the orchardists. A heavy crop of fruit often results in a glut in the consuming markets. Naturally the prices offered to the grower are low. This a part, a good portion of the harvest does not often come to the grade standards or cannot be quickly marketed.

All these wastes can be turned to good profit if side by side a fruit canning and preservation unit is set up as a side cottage industry to an orchard or groups of orchards in fruit producing centres.

At the Government Fruit Products Research Laboratory, Kodur, Cuddapah District, a three months practical training is given in upto-date fruit canning and preservation methods to students of S. S. L. C.

standard. Fruit products like Orange, Lime and Lemon squashes. Lime juice, Cordials, Fruit Jams, Jellies and Marmalades of excellent quality are now produced at Kodur. Why then the orchardists should hesitate to take advantage of the Institution ?

Choose intelligently Plants for your orchard. Twenty Himayuddin grafts supplied from Sugarcane Research Station, Anakapalle were planted in the year 1943 by Dr. Ramamurthy, Anakapalle in his garden at Kasimkota about three miles from Anakapalle, with a spacing of 40" on either side in the squire system. The trees have started commercial yields since two years consequently and the yields of the trees have worked out to 250 to 300 fruits per tree. This is a striking departure in the general performance of most of the trees of the variety Himayuddin which are known to be shy bearers as a class. The importance of the selection of clones for orchards from the choice and selected type of parent tree is evident from this experience.

Nursery growers can economise. As a result of trials conducted at the Agricultural Research Station, Taliparamba, regarding the use of various containers for potting and despatching seedlings, coconut fibre containers have been found to be convenient and cheap. These are found to reduce the potting expenses by 50% when compared to bamboo pots and by 25% when compared to mud pots. In the despatch of plants, coconut husk containers hold three times more number of plants per basket when compared with mud pot containers and twice the number of plants when compared with bamboo containers. Plants potted in coconut husk containers stand transport bѐtter than those in bamboo or mud pots. Further, the damage to the grafts through whiteand is considerably minimised by using coconut husk containers for potting seedlings, grafts or budding.

An improved Fruit grading machine. A machine for grading tight jacket oranges designed by the Research Engineer and based on an old chinest design has for sometime past been fairly In common use. It was however felt that the high cost of this machine (Rs. 175-) placed it beyond the reach of many small scale fruit growers. Further research on this subject was made and an improved and cheap grader has now been designed. The new grader is made in two sizes, the smaller for grading limes and the larger for grading tight jacket oranges and lemons. The smaller size costs approximately Rs. 50- and the larger Rs. 120.

In the Chinest pattern, the fruits are transferred one stage to the next by means of a pedal to be operated once for each such transfer. Hence the process is not one of continuous grading.

In the new grader, the fruits are fed at one end and the grading takes place as they roll down a gradient, under the force of gravity.

The fruits are graded according to "Agmark" sizes. One boy operating this machine can grade from six to seven thousand fruits in one hour. Fruits are neither crushed nor damaged in the process.

Visual Education of Farmers in Improved Methods of Agriculture. Regular tours are organised for farmers selected from the various parts of the districts and taken to the different Agricultural Research Stations to educate them on the latest 'methods pursued to increase the yields of various crops and also to acquaint themselves with the latest improved agricultural implements. The tour usually covers a period of two weeks and the entire cost is borne by the Government.

Side lines of Farming for Profit and Pleasure. Bee-keeping is one of the side lines of farming which could be undertaken both for profit and pleasure by the agriculturist. A hive is capable of producing 8 to 10 lb. of honey per annum. The farmer can supplement his income by Rs. 24/- to Rs. 30/- per hive. East Godavari District in this Province has maximum number of hives numbering over 1,200 maintained exclusively by the cultivators. A Bee-Keepers Co-operative Society is also functioning at Pithapuram which helps in the marketing of honey. The industry is getting popular among the agriculturists in that district. Farmers in other districts may follow this with profit.

"Korai Weed" can be kept under Check. Korai (*Cyperus rotundus*) is a pernicious weed in almost all the red and sandy soils. It gets naturally propagated by nuts which develop in the soils. The nuts contain the nutrients required for the growth of the grass and shoots come out from each of them when conditions are favourable. In an experiment conducted at the Central Agricultural Research Station, Coimbatore, it was found that the nuts are developed mostly within two feet depth of the soil. When the field is cultivated once in a fortnight during the fallow period either with Guntaka or with a plough, the weed is kept in check and the subsequent crop raised in the monsoon is not infested so much as in the case of the uncultivated plot. Cultivators are therefore advised to plough the field soon after the harvest of a crop and work a Guntaka or a cultivator once in a fortnight during the fallow period. Since a Guntaka can cover 3 to 4 acres in a day, it will be economical to work this implement.

Gleanings

Storing of Fertilisers: Chemical fertilisers are to-day of importance not merely because they allow farmers to farm more economically, but because they are indispensable for intensive cultivation. Consequeutly, the problems of the fertiliser industry are of importance not only to makers and users of fertilisers but to the whole world.

One such problem recently became urgent and its speedy solution by British scientists is already having important results in the use of fertilisers. It concerns the caking of fertilisers when they are stored—at first sight a trivial problem, but in fact one of very great practical importance in food production.

Every farmer knows that if he puts bags of fertiliser into store the contents tend to cake into a hard mass like cement. This occurs especially among the bags at the bottom of the pile, which get squashed the most, and when, as often happens, the storeroom is not warm and dry. This is a serious problem because fertiliser must be evenly applied to get the best results and this is impossible unless it is in the form of a free flowing powder. The difficulty is particularly great when it is to be drilled simultaneously with the seed. The farmer has to waste a busy season when he can least afford to do so.

Two Solutions: The industry has already found two ways of solving the problem, but, unfortunately, the demand for fertilisers is now so huge that the solutions cannot be applied to the industry's total output. One solution is to store fertilisers in huge bins and deliberately allow them to cake. Then they are ground up a second time and it is found that there is then little caking tendency left. This was quite feasible as long as the demand for fertilisers was seasonal—chiefly in spring—because this left several months of the year free for them to mature in their bins. Now, however, the demand for more and more fertilisers is incessant. Production takes place all the year round and the huge storage space required for this method is no longer available.

The second solution to the problem is to form fertilisers into little hard granules which do not stick together nearly as easily as the usual fine crystals. However, as well over a million tons of fertilisers are used every year in Britain alone, there is not—nor is there likely to be for a long time—nearly enough machinery to deal in this way with more than a fraction of the flood of material.

Because of the urgency of the problem, chemists of the Department of Scientific and Industrial Research were asked to find a solution quickly—in fact within eight months. This short time limit immediately disposed of any ideas chemists may have had about making a thorough laboratory study of all the factors involved and then proceeding logically to a remedy. Instead, they had to apply all their scientific knowledge and intuition to finding by rule of thumb means some remedy—not necessarily the best or the only one—which would quickly relieve the situation.

Caking Tendency: Firstly, they had to work out a way of measuring the degree of caking. This was finally done by measuring the pressure necessary to make specially prepared cakes crumble up. The more severe the caking the greater the pressure needed to break it up again.

Next, it was decided that the most likely way of solving the problem would be to mix into the fertiliser some powder which might keep the crystals apart and so stop them from caking. It is perhaps much the same idea as dusting newly amended tyre puncture with chalk to stop the inner tube from sticking to the cover.

The powder they sought, apart from minimising caking, had to fulfil a number of conditions. It had to be possible to add it to fertiliser during the dry mixing process, it had to be harmless to plant and soil, cheap and available in the U. K. in quantities of

10,000 to 15,000 metric tons a year. Not all substances tried out would fulfil these conditions, but it was essential to examine a sufficient range in order to obtain some idea of the types of material which might be serviceable.

With little to guide them, the chemists patiently tried the effect of mixing various powders into the fertiliser and then they measured the caking tendency of the product. The powders they tested were extraordinarily varied and included fish meal, brick dust, powdered seaweed, sawdust and dried blood.

Best Agents: Powders of mineral origin—such as brick and stone dust—proved quite useless. Indeed, they made matters worse rather than better. Finally, shredded peat or sawdust were found to be the best agents, reducing caking to between one-third and one-fifth of what it was when no conditioner was present. Chopped straw is just as effective but not so easy to handle. The addition of peat or sawdust—about one part in 30 is needed—will not lower the value of fertilisers because manufacturers always add a small quantity of filler to make the proper balance between different plant nutrients. All that will be necessary will be to replace a part of the filler with sawdust or peat.

Quite apart from the anti-caking agent, storage conditions too are important. Bad storage and exposure to weather can cause much more severe caking than when fertiliser is kept dry.

It seems a far cry from the prevention of an apparently minor defect in a product the general public rarely sees, to an important increase in the world's food supplies. Nevertheless, this is the result which will be obtained, for the new discovery means that far greater quantities of fertiliser will be available for the farmer in good condition at the time they are needed. (British Information Service / 341).

Weeds May Become Assets: Agriculturists in Australia believe that at least three weed pests can be turned into profitable crops. There is a strong possibility that the saffron thistle (*Carthamus lanatus*) which is on the Australian list of prohibited noxious weeds will be cultivated as a crop. The seed has good oil properties and is valuable as turkey feed. One firm of oil and fodder cake manufacturers is buying seed at 6 pence a lb. Last year when harvesting experiments were carried out with saffron thistle, it was found that the crop could be reaped with a normal harvester provided that every alternate tooth was removed from the comb. The seed is larger than wheat grain and must be harvested before absolutely ripe or the oil content deteriorates.

Samples of another weed, *Sida rhombifolia* or common sida, are being sent to England to discover whether the plant can be used in place of Indian jute for making hessian and sacking. Experts believe that the fibrous nature of the plant should make it suitable for sack-making. Experiments with the seed of wild turnip (*Brassica tournefortii*) for the extraction of oil promise a use for this weed, now considered a menace by wheatgrowers. A South Australian miller who is already exporting large quantities of mustard seed oil to India and south-east Asia claims that he has produced equally good oil from wild turnip seed. The oil has the same purity (98 per cent), tastes sweeter, has clearer colour and will not go rancid. It can be used for culinary purposes and as a base for perfume and cosmetics, while the residue makes good laying mashes for poultry farmers. AGN. / 227.

Rain by Radar: Radar is being used by a group of Australian scientists from the Council for Scientific and Industrial Research in experiments with the object of making rain. They are concentrating on three phases:

(1) Studies of the effect of "seeding" clouds with dry ice pellets (2) study of clouds structure (3) Development of instruments to measure physical conditions in and around cloud.

There are, however, many problems to face. Speaking on the experiments, the Minister in charge of the Council for Scientific and Industrial Research, the Hon. J. J. Dedman said: "First you have to find the clouds. Then there is the prospect that some people in the area chosen for rain-making do not want rain, and the question arises whether the Government will be liable for damages for causing rain to fall". (AGN. / 227)

New Farm Compost: In Australia, a Municipal Council is turning garbage into an organic manuring material, similar to compost. Garbage rich in discarded food is preferred. After picking over for tins, metal and glass, the garbage passes by conveyor belt to a hopper. Here bacterial seed, in earth, and a small amount of lime, are added and the mixture conveyed to the bacterial digester. In this 50-ton container, the matter is slowly stirred and mixed together for two days. The bacteria, it is claimed, converts the garbage into good manure, which Government analysts say will eventually turn into compost. From 100 tons of garbage about 50 tons of marketable product is obtained. This sells at £A5/15/- a ton bagged or £A3/15- in bulk. A quantity of the manuring material has already been sold to the Murrumbidgee Irrigation Area in New South Wales, and 500 tons are on order for banana growing at Coffs Harbour, northern New South Wales. (AGN. / 229).

Butter-Tainting Weeds Traced: After an Australia-wide survey of all weeds believed responsible for tainting butter, scientists have isolated three plants which they consider do the most damage. Weeds are: *Coronopus didymus*, (lesser swine cress or carrot weed); *Lepidium hyssopifolium*, (pepper cress, mustard weed or pepper wort); *Lepidium beonariense*, (rubble pepper cress and mustard weed). Weed taint causes thousands of tons of Australian butter each year to fall below the choicest standard quality. Officers of the Australian Council for Scientific and Industrial Research, the Queensland Butter Board and the Queensland Department of Agriculture and Stock have made an extensive study of weed taint at Gatton College, Queensland. Plants selected from the Australia-wide survey as being most likely to impart taint to butter were used in feeding trials. At the same time, laboratory tests were carried out in an effort to eliminate taint from butter. Now that the three weeds causing the most trouble have been discovered, dairy farmers have been advised to eliminate them from grazing paddocks, and to conserve fodder as alternative feed-stuffs for cows so that their intake of tainting plants will be reduced. So far no satisfactory method of extracting taint from butter in the factory has been evolved. (AGN. / 228).

More Tomatoes from Spray Irrigation: Quickening Australian farmer interest in spray irrigation and rapid engineering advances in this method have prompted experiments in the Murrumbidgee Irrigation area of New South Wales, which show that spray irrigated tomatoes grown on heavy soil give better yields than furrow irrigated plants.

Comparative yields were:— Furrow irrigated 6·4 tons to the acre.
Spray irrigated 10·1 tons to the acre.

In the first month, when furrow irrigated plants were receiving more water than spray irrigated plants, growth was more rapid in the former because of rapid initial soakage in the freshly made furrows. Towards the middle and end of the season, however, the spray irrigated plots rapidly overtook and surpassed the furrow irrigated ones. The experiment established that spray irrigation of vegetables on heavy soil is both practical and economic and is distinctly advantageous where moderate salting is present. (AGN. / 228).

Toxaemic Jaundice Discovery Made: Agricultural scientists in Australia have discovered that heliotrope weed (*Heliotropium europaeum*) causes toxaemic jaundice in sheep This weed had often been suspected as a poisonous plant, but laboratory tests and experiments with groups of sheep had failed to prove that it caused jaundice. This was because the poison takes a long time to work through the blood stream to the liver and it is only when the poison accumulates in the liver that it proves fatal. Toxaemic jaundice has killed off many crossbreed sheep in Australia in the last 20 years. Now that one of its causes has been discovered, fat lamb production can be expected to increase. (AGN. / 228).

Agricultural College and Research Institute Library, Lawley Road, Coimbatore.

MONTHLY LIST OF ADDITIONS FOR FEBRUARY 1949

1.	BURTON (W. G.): Potato a survey of its history and of factors influencing its yield, nutritive value and storage	1948
2.	COLLINGS (Gilsort H.): Commercial Fertilisers, their sources and use Edn. 4.	1947
3.	FLETZ (David): Atomic enegy now and tomorrow.	1946
4.	EASTER (Stephen S.): Preservation of grains in storage: papers presented at the International meeting of infestation of food-stuffs, London 5th—12th August 1947.	1948
5.	FAULKNER (Edward H.): Ploughing in prejudices.	1948
6.	GILBERT (Frank A.): Mineral nutrition of plants and animals.	1948
7.	HABLER (Agaes W.): Garden in the plains Edn. 3.	1948
8.	HAYES (B. C.): Techniques of Observing the weather.	1947
9.	KENT JONES (D. W.) and AMOS (A. J.): Modern Cereal Chemistry Edn. 4.	1947
10.	LYON (T. Lyttleton) and BUCKMAN (Hary O.): Nature and properties of soils Edn. 4. Revised by Harry O. Buckman.	1948
11.	MARKLEY (Klare S.): Fatty acids, their chemistry and physical properties	1947
12.	RANGANATHAN (S. R.): Preface to Library Science.	1948
13.	RANGAPPA (K. S.): and ACHAYA (K. T.): Chemistry and manufacture of Indian Dairy Products.	1948
14.	SHAW (K. T.) *Ed*: Land policy, Agricultural Labour and Insurance	1948
15.	SMITH (K. M.): Text book of Agricultural Entomology Edn. 2.	1948
16.	WHITE (John M): Farmers Handbook.	1948
17.	BRITISH MYCOLOGICAL SOCIETY: 1896—1946: Proceedings of the Jubilee Meeting held in London 20—25 October 1946.	1948

Crop and Trade Reports.

Statistics—Cotton—1948—'49—Second Forecast Report.

The average area under cotton in the Madras Province during the five years ending 1944 '45 represents 10·7 per cent of the total area under cotton in India. The area under cotton upto 25th September 1948 is estimated at 3,76,000 acres. When compared with the area of 3,72,400 acres estimated for the corresponding period of last year, it reveals an increase of 1·0 per cent.

Central Districts and the South—Mainly Cambodia Tract: The area in the Central districts and the South relates partly to the last year's crop and partly to the current year's sowings which have commenced in parts. The area in this tract fell from 68,500 acress to 5,57,000 acres i.e., by 18·7 percent, mainly due to want of adequate rains at the time of sowings.

Westerns Tract: The area under Westerns increased from 2,21,900 acres to 2,41,300 acres i.e., by 8·7 per cent. The increase is due mainly to an increase is due mainly to an increase in the area under Hingari Cotton in Bellary District (21,000 acres).

White and Red Northerns: The area under white and Red Northerns increased from 27,100 acres to 27,700 acres i.e., by 2·2 per cent.

Warangal and Cocanadas: The area under Warangal and Cocanadas fell from 51,900 acres to 48,800 acres i.e., by 6 per cent, as the sowings were delayed due to late receipt of rains.

The condition of the Crop is reported to be generally satisfactory except in the districts of Bellary and Anantapur where the yield is expected to be below the normal due to delayed and inadequate rains. The crop in the Bellary District is also reported to have suffered from an attack of hairy caterpillar pest in the early stages.

The average wholesale price of Cotton lint per Imperial Maund of 82,2/7 lbs. (equivalent to 3,200 tolas) as reported from important markets on 16th October 1948 was Rs. 44—1—0 for Cocanadas, Rs. 41—15—0 for Westerns (Mungari), Rs. 81—13—0 for Coimbatore Cambodia, Rs. 71—3—0 for Coimbatore Karunganni, Rs. 69—5—0 for Virudhunagar Karunganni, Rs. 57—12—0 for Tinnevellies and Rs. 52—8—0 for Nadam Cotton When compared with the prices published in the last report i.e., those which prevailed on 11th September 1948, those prices reveal a rise of approximately 5% in the case of Cocanadas and Coimbatore Karunganni and 8% in the case of Coimbatore Cambodia, and a fall of 6% in the case of Virudhunagar Karunganni and 5% in the case of Nadam Cotton. The price remained stationary in the case of Westerns (Mungari).

Statistics—Crop—Sugarcane—1948—Third or Final Report:

The average area under sugarcane in the Madras Province during the five years ending 1944—'45 represents 3·4 per cent of the total area under sugarcane in India.

2. The area planted with sugarcane in 1948 is estimated at 2,08,840 acres. When compared with the corresponding estimate of 2,47,430 acres for the previous year and the actual area of 2,72,680 acres according to the Season and crop report for 1947—'48, the present estimate reveals a decrease of 15·6 per cent and 23·4 per cent respectively. The estimate of the previous year was below the actual area by about 9·3 per cent.

3. 42,190 acres have been reported as sown since the last forecast was issued in October 1948, made up of 6,760 acres in the Circars, 5,800 acres in Deccan, 6,060 acres in the Carnatic, 19,800 acres in the Central districts, 3,100 acres in the South and 670 acres in the West Coast,

4. The estimated area is the same as that of last year in Guntur. An increase in area is estimated in Krishna and Malabar and a decrease in all the other districts of the Province due mainly to a general fall in the price of jaggery at the time of planting. The decrease is marked in Bellary (-4,820 acres), South Arcot (-10,080 acres), Central districts (-32,790 acres) and Mathurai (-7,650 acres).

5. The present estimate includes an area of 20,750 acres under ratoon sugarcane in the districts of Vizagapatam (200 acres), West Godavari (5,400 acres), Krishna (1,000 acres), Bellary (3,500 acres), Anantapur (800 acres), South Arcot (2,100 acres), Chittoor (4,000 acres), North Arcot (200 acres), Tiruchirapalli (1,500 acres), Mathurai (1,900 acres) and Malabar (150 acres).

6. The harvest of the crop has commenced. The yield per acre is expected to be normal in Tirunelveli, Malabar and South Kanara and below the normal in the other districts of the Province due mainly to the fact that the crop has been affected adversely by want of adequate rains during the growing period.

The seasonal factor for the Province as a whole is estimated at 89 per cent of the normal as against the estimate of 90 per cent in the Season and Crop report of 1947—'48 and 89 per cent in the final forecast of the previous year. On this basis, the yield is estimated at 5,253,890 tons of cane, the gur equivalent of which is 579,490 tons, as against an estimate of 680,770 tons in the final forecast report of the previous year and 6,818,380 tons of cane with a gur equivalent of 753,430 tons according to the Season and crop Report of 1947—'48. The present estimate reveals a decrease of 23·0 per cent in case of cane and 23·1 per cent in the case of gur as compared with the figures in the Season and crop report of the previous year.

7. The wholesale price of Jaggery per Imperial Maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important market centres on 12th February 1949 was Rs. 17—13—0 in Erode, Rs. 16—3—0 in Tiruchirapalli, Rs. 15—10—0 in Salem, Rs. 13—3—0 in Vellore, Rs. 12—8—0 in Mangalore, Rs. 11—2—0 in Bellary, Rs 10—13—0 in Adoni, Rs. 10—5—0 in Chittoor, Rs. 10—1—0 in Vizianagaram, Rs. 9—14—0 in Rajahmundry, Rs. 9—1—0 in Kakinada, Rs. 8—14—0 in Vizagapatam. When compared with the prices published in the last report, i. e., those which prevailed on 18th December 1948, these prices reveal a rise of approximately 29 per cent in Bellary, 10 per cent in Kakinada, 9 per cent in Chittoor and 7 per cent in Vellore and a fall of approximately 39 per cent in Vizagapatam, 8 per cent in Vizianagaram, Rajahmundry and Tiruchirapalli and 1 per cent in Salem, the prices remaining stationary in Adoni, Erode and Mangalore. (From Public and Economics Statistics Dept.)

Cotton Raw, in the Madras Province: The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February, 1949 to 4th March, 1949 amounted to 4,311 bales of 400 lb lint as against an estimate of—bales of the total crop of 1948—'49. The receipts in the corresponding period of the previous year were 18,350 bales. 38,077 bales mainly of pressed cotton were received at spinning mills and 959 bales were exported by sea while 22,665 bales were imported by sea mainly from Karachi and Bombay. (From Director of Agriculture, Madras).

Weather Review—For February 1949.

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches	Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	Nil	—0·9	Nil	South.	Negapatam	Nil	—0·8	0·5
	Calingapatam	0·2	—0·4	0·3		Aduturai*	Nil	—0·4	Nil‡
	Vizagapatam	Nil	—0·9	0·4		Pattukottai*	Nil	—0·4	0·4
	Anakapalle*	Nil	—0·1	0·2		Mathurai	Nil	—0·5	0·9
	Samalkot*	Nil	—0·3	Nil		Pamban	Nil	—0·9	6·2
	Kakinada	0·1	—0·2	0·1		Koilpatti*	1·3(x)	+0·8	1·9
	Maruteru*	Nil	—0·1	Nil		Palamcottah	0·7	—0·5	1·0
	Masulipatam	Nil	—0·5	Nil		Amba-samudram*	Nil	—1·2	1·2
	Guntur*	Nil	—†	Nil					
	Agri. College, Bapatla	Nil	—0·4	Nil	West Coast.	Trivandrum	Nil	—0·8	0·3
	Veeravanam (College Farm)	Nil	...	Nil		Cochin	Tr.	—0·8	Tr.
						Calicut	Nil	—0·7	Nil
						Pattambi*	Nil	—0·1	Nil
Ceded Dists.	Kurnool	Nil	—0·3	Nil		Taliparamba*	Nil	—4·2	Nil
	Nandyal*	Nil	Nil	Nil		Nileshwar*	Nil	—0·1	Nil
	Hagari*	Nil	—0·1	Nil		Pilicode*	Nil	—0·2‡	Nil
	Siruguppa*	Nil	—0·3§	Nil		Mangalore	Nil	—0·2	Nil
	Bellary	Nil	—0·2	Nil		Kankanady*	Nil	—0·1	Nil
	Rentichintala	Nil	...	Nil					
	Cuddapah	Nil	—0·1	Nil	Mysore & Coorg.	Chitaldrug	Nil	—0·1	Nil
	Anantharajpet*	Nil	—0·1	Nil		Bangalore	0·3	Nil	0·3
Carnatic.	Nellore	Nil	—0·2	Nil		Mysore	Nil	—0·2	Nil
	Buchireddi-palem*	Nil	—0·5	Nil					
	Madras	Nil	—0·4	Nil	Hills.	Mercara	Nil	—0·2	0·1
	Tirurkuppam*	Nil	—0·8$	Nil		Kodaikanal	0·1	—1·4	1·0
	Palur*	Nil	—0·4	Nil		Coonoor*	Nil	—2·1	Nil
	Tindivanam*	Nil	—0·1	Nil		Ootacamund*	Nil	—0·3	Nil
	Cuddalore	Nil	—0·9	Nil		Nanjanad*	Nil	—0·6	Nil
Central.	Vellore	Nil	—0·3	Nil					
	Gudiyatham*	Nil	—0·2	Nil					
	Salem	0·1	—0·2	0·1					
	Coimbatore (A. C. R. I.)*	0·1	—0·1	0·1					
	Coimbatore (C. B. S.)*	Nil	—0·1	Nil					
	Coimbatore	Nil	—0·4	Nil					
	Tiruchirapalli	Nil	—0·5	Tr.					

Note :—
(1) * Meteorological Stations of the Madras Agricultural Department.
(2) Average of ten years data is taken as the normal.
(3) $ Average of six years data for Tirurkuppam, and seven years for Pilicode is given as normal.
(4) § Taluk office rainfall is Nil
(5) ... Figures not available.
(6) ‡ The actual total from 1—1—49 is 0·03".
(7) Tr. = Trace - ActualRainfall is 0·01" for Tiruchirappalli and between 0·1" to 0·4" for Cochin.
(8) (x) Actual rainfall is 1·25" and that too received on one day i.e., on 10—2—49.
(9) † Actual figure is 0·02".

Weather Review for February 1949.

A number of western disturbances occurred over Punjab and Sind in the first week of the month under review.

On 6—2—1949 a cold wave was found moving through the West Central Provinces, Berar, Saurashtra and Cutch and the northern half of the Bombay Province where night temperatures had fallen appreciably. The next day it enveloped Saurashtra and Cutch, the central parts of the country, the whole of the Bombay Province and the Hyderabad State. On 7—2—1949 the night temperatures were as much as 10° to 16° F. below normal in the north Bombay Deccan, the West Central Provinces and Berar. On the same day Malegaon recorded a minimum temperature of 38° F. This cold wave extended on 8—2—1949 eastwards into North-East India and southwards into the Madras Deccan and the north Madras Coast where there had been large falls in night temperatures. The next day it became unimportant.

The elongated trough of low pressure over the sub-montane districts of the United Provinces and Bihar, noted on 18—2—1949 became noticeably marked two days later and unimportant on the fifth day,

The weather throughout the Madras Province in the month of February 1949 was practically dry. Day temperatures were generally below normal. Night temperatures happened to be invariably above normal in Tamilnad and Andhradesa. Towards the end of the month night temperatures became below normal while the days were warmer than usual. On 10-2-1949 a few showers occurred in South Kerala and adjoining Tamilnad. Periodic appearance of mist or fog over Mysore Plateau was the main feature of the weather conditions during the month under review. The note-worthy fall in the Madras Province occurred only at Koilpatti on 10-2-1949 to the tune of 1·25". M. B. V. N & C. B. M.

Departmental Notifications

GAZETTED SERVICE—APPOINTMENTS

Sri A. R. Seshadri B. Sc. (Hons.) is appointed as Assistant Entomologist, Singampatti

The following subordinates appointed as Superintendents of Liaison Farms in Sugar Factory areas are posted to the Centres noted against each.

Sri C. Ekambaram, Farm Manager, Gudiyattam, ... Hospet
" C. S. Krishnaswami Ayyar, Teaching Assistant in Agriculture, Coimbatore ... Nellikuppam
" M. Lakshmikantham, Agricultural Demonstrator, Yellammanchilli ... Samalkot
" S. Ramaswami, Special Agricultural Demonstrator, Vellore ... Pugalur

POSTING AND TRANSFERS.

Name of Officers	From	To
Sri Ananthapadmanabha Pillai, R.	P. A. to D. A. O., Vellore,	Agronomist, A. R. S., Siruguppa.
" Jagannatha Rao, C.	Assistant Cotton Specialist, Bellary,	Cotton Specialist, Coimbatore.
" Seetharamiah, P.	Assistant in Agronomy, Anakapalle,	Assistant Agronomist, Anakapalle.
" Veerabhadra Rao, K.	P. A. to D. A. O., Nellore,	D. A. O., Anakapalle.

II. SUBORDINATE SERVICE.

NEW APPOINTMENTS.

Name of Officers	From	To
Sri Suryanarayana K	...	F M., A. R. S.. Koilpatti.
Miss. Santha Raghavan,	...	Assistant in Botany, Coimbatore.

POSTING AND TRANSFERS.

Name of Officers	From	To
Sri Chiranjeevi, V	F. M , Araku Valley,	A. D., Sompeta.
" Doraiswami, G.	A. D., Virdachalam,	A. D., Trichengode.
" Krishnamurthi, R.	A. D., Conjeevaram,	A. D , Papanasam.
" Krishnaswami Sarma, M. C.	A. D , Melur,	F. M., A. R. S., Palur.
" Krishniah V. V.	Ento. Myco. Training,	A. D., Gudur.
" Kanaka Rao, G.	Entomology Assistant Plant Protection Scheme, Bellary,	F. M., Araku Vally.
" Lakshmipathi Rao, V.	Ento-Mycology Training, Coimbatore	A. D., Maduranthakam
Mr. Maqbaboor Rahiman,	"	Mycology Assistant, Nellore.

Name of officers	From	To
Sri Narayana Reddy, M. L.	On leave,	A. D., Chodavaram.
„ Nageswara Sarma, D.	Mycology Assistant, Nellore,	A. D., Rapur.
„ Nagaraja Rao, K. R.	Assistant A. R. S., Siruguppa,	Assistant DDT. Scheme, Coimbatore.
„ Ponniah, J. H. S.	F. M., A. R. S., Palur,	A. D., Ambasamudram.
„ Rama Rao, S.	A. D., Gudur,	P. A. to D. A. O., Nellore.
„ Rajagopalan, V. T. R.	Assistant in Entomology, Coimbatore,	Assistant in Entomology, Nellikuppam.
„ Ranga Rao, K.	Ento-Mycology Training, Coimbatore,	Teaching Assistant in Agriculture.
„ Rama Mohan Rao, K.	Ento-Mycology Training, Coimbatore,	Entomology Assistant, A. R. S.. Anakapalle.
„ Ramanjaneyulu, S.	Ento-Mycology Training, Coimbatore.	A. D., Koilkuntla.
„ Satyanarayana, T.	A. D., Trichengode,	Special A. D., Sendarampalli.
„ Satyanarayana K.	A. D., Koilkuntla,	A. D., Chirala.
„ Subba Raju, A.	Ento-Mycology Training, Coimbatore,	F. M., Liaison Farm, Samalkot.
„ Sundaresan, K. R.	A. D., Tirukoilur,	F. M., Liaison Farm, Nellikuppam.
„ Saptharish, K.	Assistant in Paddy, Coimbatore	Assistant in Paddy, A. R. S., Aduthurai.
Miss. Sarojini Dhamodharam,	On leave,	Assistant in Mycology, Coimbatore.
Mr. Syed Muhammad, D. A.	On leave,	P. A. to D. A. O., Vellore.
„ Sundara Rao, Y. R.	Assistant in Fruits,	Inspector for the enforcement of Fruit products.
„ Uttaman, P.	Assistant in Paddy, A. R. S., Aduthurai,	Assistant in Paddy, Coimbatore.
„ Venkatarama Reddy, T.	Ento-Mycology Training,	F. M., Liaison Farm, Hospet.
„ Viswanandam, Y.	Ento-Mycology Training, Coimbatore,	Entomology Demonstarator, Bellary.
„ Venkatasubramanian, V.	On leave,	A. D., Ambasamudram.

The Madras Agricultural Journal

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TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high — and the Editorial Board will feel obliged if your articles are brief.

The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI April 1949 No. 4

Editorial

Raw Cotton Production: The Partition of India and the compulsory curtailment of cotton acreage during the war have very adversely affected the raw cotton production of the Indian Union. Recent reviews of cotton stocks and the distress appeals preferred by the Textile Industry for the improvement of the tight raw cotton supply position to mills are sufficient pointers to indicate that we are heading towards a cotton famine. The factual position for the cotton year 1948—'49 as announced on the floor of the parliament placed the mill consumption at 46 lakh bales and extra factory consumption at 2·7 lakh bales. The total requirement of 48·7 lakh bales was proposed to be met from the domestic production of 26 lakh bales, carry over stocks the extent of 10·9 lakh bales, Pakistan supply of 6·5 lakhs, East African imports of 2 lakhs and supplies from U. S. A., Brazil, Egypt and Sudan amounting to 3·3 lakh bales. These arrangements would help us in tiding over the present crisis but the rate at which we are eating into the carryover stocks would only put off the evil day. In fact it is apprehended that we will be unable to tide over the period between September and December 1949 without adequate imports.

The policy of the Government in regard to raw cotton has been criticized by the trade who hold the view that looked at from any angle, the policy has miserably failed. The ceilings fixed by Government remain only on paper and business on lint has considerably thinned. The market for cotton is one of trading in seed cotton which can be purchased at substantial premiums over the ceiling parity without infringing the law. Many mills have been forced to adopt this device and sacrifice part of their manufacturing margins. The less resourceful smaller mills are compelled to notify closure or curtail employment of labour.

The Government reviewed the cotton production and price structure for the ensuing year at a recent meeting in Delhi where all interests were represented. The target of cotton production for 1949—'50 has not yet been announced but plans are afoot to raise the acreage by about two million without in any manner affecting the

Food programme. It is also stated that an expert committee is working out the differentials in prices between different varieties of cotton on the basis of merits, and that their decisions will be made known by the end of this month.

There is a case for raising the ceilings of cotton so as to bear a fair relationship to the cost of imported cotton. The very fact that many of the mills are able to pay prices higher than the controlled rates proves that an upward price revision is quite possible. There is plenty of force in the remarks of the President of the East India Cotton Association who stated "to make frantic efforts to depress the price of Indian Cotton and to send Cotton Missions abroad for the purchase of cotton at relatively much higher prices is an absurdity." Unless a sound cotton policy is framed, India will be forced to expend her sterling and dollar exchange for a commodity which as exportable surplus helped her to maintain a favourable balance of trade in pre-war years.

An analysis of the post-war needs of the Mill Industry in Madras, would place the ultimate consumption at 425,000 bales in each of American and *desi* cottons Madras will be obliged to double her production, increase the output of quality American and convert all short-staple into medium staple cottons. In such a drive, the gaps in production can either be made up by higher yields per acre or increase in acreage. The methods must suit the conditions of peasant farmers who form the bulk of the cotton growers in the province and whose joint contribution even at small levels of increase will ultimately result in a substantial over-all production without the need for providing vast amounts for capital expenditure or special equipments. There are certain tested cultural practices and crop mixtures which if extended to both the cotton and the non-cotton growing regions, will affect to a very large degree the production deficit. Improvement of irrigation sources in cotton areas where the lands are subject to intensive cropping will materially augment production. Utilisation of rice fallows in deltas and rainfed regions is a long range plan which is likely to yield a good dividend. Madras with the sanction of four new breeding schemes and plans for increasing the acreage and the supply of certified seeds to the cultivators will eventually be able to draw her full requirements from the internal growths. This together with plans for extension of area under irrigated cotton in East Punjab, (including the adjoining states) and Mysore will it is hoped raise India to her former place in the cotton growing countries of the world.

A Study of Arecanut Production in South India

By

K. T. SHETTY, B. Sc., (Ag.,)
(Horticultural Diploma Course, Madras.)

Ranked as one of the principal commercial crops of South India, the arecanut *(Areca catechu)* has also been a very popular masticatory all over this country from times immemorial. Either by itself in its varied fresh or processed forms or in combination with the leaves of the betel vine *(Piper betel)*, a little lime and sometimes with also pieces of clove, nutmeg, tobacco etc., the arecanut has become an almost invariable feature of Indian hospitality. "*Pansupari*" is the name by which this dessert or after-dinner masticatory is known all over India, representing perhaps the largest common factor in the dietary habits of the people of this sub-continent. In rituals and offerings too, the nut or inflorescence of the areca palm has gained for itself a great prominence in South Indian life, so that this crop is entitled to be reckoned as an essential part of the life and living of the inhabitants of this part of the country. A study of this crop and its production methods will have, therefore, an interest and value from the view points of the South Indian economy no less than that of the social life of the region.

Historical. Grist (1926) has stated that the betelnut which is synonymous with arecanut, has been a source of trade between India, Ceylon, Indonesia and Malaya from the remotest periods of history. The belief has been held that Malaya might perhaps be the original home of this nut. Sands, quoting from Ridley's book on "Flora of the Malay Peninsula" provides evidence to the contrary, since Ridley had never seen the palm in a wild condition in Malaya nor did it aspear to establish itself outside cultivated ground, though he has recorded that the palm was under cultivation in Malacca before 1593. A more ancient reference to the palm is found in a Chinese work dated 140 to 80 B. C. under the name Pinlang, which is evidently a perversion of Pinang. The affinity of this term to "Penang nut" which is the name by which arecanut was widely known in Malaya Peninsula and Sumatra may be obvious. It seems also obvious from these and other facts that the palm was existing in Malaya and possibly in Philippine group of islands from historical times. Beccari, however, is definite that in no other part of Asia or Malaya, excluding the Philippines, was any species of areca found or any other species remotely similar to the *Areca catechu*. Till more

evidence comes to light, the original home of the palm as also the date of its introduction into India has to remain shrouded in mystery, the only possible surmise is that the nut was probably brought into this country by the Indian labourers for chewing purposes from the Philippines (4) or from Ceylon

Trade. According to Grist, arecanut formed an important exported commodity from Ceylon to India and was the chief medium of exchange for the grain which the natives of Ceylon have for centuries drawn from Southern India. From the figures furnished from Calcutta (3) for 1918—1919, the foreign trade in this nut for the whole of undivided India was as under.

Exports.		*Imports.*	
Quantity	Value	Quantity	Value
3,62,419 lbs.	£. 8,119	142,527,683 lbs.	£. 1,141,269

The imports to Madras Presidency in recent years can be gauged from the following figures supplied by the Provincial Marketing Officer, Madras.

Year.	*Imports in Cwts.*	*Value in Rupees.*
1938—1939.	2,79,801	not known
1944—1945.	74,236	32,79,337
1946—1947.	1,41,629	more than a crore.

From the foregoing it may be concluded that the country is very much in deficit in respect of the nut, and there is therefore a very considerable headway to be made in stepping up the production. That even the leading areca producing province like Madras should be dependent on outside sources for her areca supply to the tune of more than a crore of rupees, is a feature that should set everyone thinking on the methods necessary for bridging the gap between the demand and production. In the case of a crop like areca, for the production of which, ideal conditions exist in South India, there is no possible reason why production cannot be augmented, not merely to make South India self-sufficient but also to cater to the huge demand in other parts of the country. This is a line of development that seem to deserve urgent consideration in our national crop-planning.

Production. The Provincial Marketing Officer, Madras, has estimated that the Madras Presidency produces annually, 5,45,150 cwts. of arecanut valued at Rs. 5,45,15,000 (1946—47). This is from an

estimated area of 1,07,000 acres which works out to an acre yield of about 5 cwts. The figures of acreage under areca as furnished by the Special Officer, Arecanut Survey, Ernakulam, are presented below:

Assam	...	...	27,200 acres.
Bengal	...	...	5,700 ,,
Bombay	...	...	19,400 ,,
Cochin	...	...	24,400 ,,
Coorg	...	...	800 ,,
Madras	...	...	1,07,000 ,,
Mysore	...	...	37,100 ,,
Travancore	...	...	40,000 ,,
Other parts	...	...	1,800 ,,
		Total ...	2.63,400 acres.

In acreage and money value, the areca occupies even at present an important place in the economy of this Province. Considering the need for the extension of production and the possibilities thereof, it would appear that areca is a crop that deserves more attention than that it enjoys at present. Such attention has to be based mainly through planting of additional area and by effecting improvements in production methods. It has to be noted that at present South India claims 79·5% of the total areca area in the country which fact entitles the crop to be deemed as of chief importance to this region. Any work designed to foster greater and better production of the area should, therefore, be conceived principally against the background of South India's peculiarities and potentialities.

Out of the total area of 2,63,400 acres of arecanut grown in the Indian Union, 1,07,000 acres are in Madras Presidency alone and 2,09,300 acres in South India including Cochin, Travancore, Mysore and Coorg, that is 79·5% of the total area. It has already been pointed out, how Madras is importing more than one crore of rupees worth of nuts every year and how important it is to make the province self-sufficient in arecanut. There is scope for tackling this problem both by increasing the area and improving the yield of the existing gardens.

It should be noted that practically no work has been done on the improvement of arecanut in India except the work to control "*Mahali* disease". As such there is practically no literature available

on the various aspects of the arecanut crop. It is time that serious attention is paid to the improvement of this important commercial crop and it is really good news that the Government of India have taken up the matter and appointed an Agricultural Officer to conduct a survey of the crop. It is hoped that a separate committee like the Indian Central Coconut Committee, will be started soon with research stations for the improvement of arecanut.

The areca palm is widely distributed in tropical countries where climatic conditions are suitable for its growth. It is grown in India, Ceylon, Federated Malay States,, Straits Settlements, Sumatra, Java and other East Indian Islands.

Uses of Areca. The uses of the palm are many. The most important is the nut which is used chiefly as a masticatory by the people of Eastern races and with the natural increase in population the demand for the nut is steadily increasing.

Sands (1926) has recorded — "To the taste the nut is astringent and slightly acid; it possesses also narcotic and anthelmintic properties. These properties are due mainly to the alkaloid "Arecoline"; but three other closely allied alkaloids have also been isolated. The alkaloids are said to occur in the light coloured endosperm and not in the dark brown or red portions which contain the colouring matter."

The powdered nut owing to its astringent action on the gums is used as a dentifrice and in veterinary practices as an anthelmintic. The nut when boiled with water gives a decoction and this is used in the preparation of dyes, in tanning and in the preparation of catechu. The stem is used as rafters and pillars for sheds and also as fuel. The leaves are useful as fuel and the midribs for the preparation of brooms. The leafsheaths are used as plates and for the preparation of hand tans, caps, packing material etc. The roots are used in medicine (5).

Description of the Palm. For an understanding of the areca production methods, it will be useful to have an idea of the growth and fruiting habits of the palm.

The palm is unquestionably one of the graceful plants, with an appearance and dignity all its own. The sight of the areca plantations skirting the ghat road from Mettupalayam to Ooty is a sight never forgotten by those who enjoyed it. Even in a home garden or a park,

the clean and supple stem rising to great heights with straight lines add a beauty which is an asset whether as individual specimen or in groups as in avenues.

Sands has recorded that the palm reaches a height of 60 feet but in South India much larger heights are not infrequently seen. The stem is cylindrical, 5 to 8 inches in diameter and ringed distinctly from the base upwards by the scars of the fallen leaves. The stem is green when young but assumes a greyish colour with age. The stem is tough and strong and is not readily broken by wind. It is held up by strong roots both above and below ground. The crown of leaves is compact with a diameter of about 8 feet. The leaves are pinnate from 4 to 6 feet long with a long sheathing base which completely encircles the stem. The leaflets are numerous, 1 to 2 feet long, 1 to 1¼ inches wide, some of which may remain joined together.

Flowering. Under favourable conditions the palm commences flowering when it is about 4 years old. Each inflorescence or spadix is closely covered by a leaf sheath until a few days before it is ready to open Further, the spadix is completely enclosed in a sealed, double boat shaped, flattened spathe about 2 feet long and 7 inches wide in its broadest part. The inner and the upper side of the spathe is much thinner and weaker than the outer and the lower side, so that the expanding spadix easily bursts the spathe open along its upper side in a central longitudinal line and frees itself.

The spadix is short stalked, 1½ to 2 feet long, with numerous branches and unisexual flowers. Each secondary or tertiary branch bears one to several female flowers near its thickened base; whilst an abundance of male flowers are produced on special filiform branches, 6 to 10 inches long, which arise below and extend beyond the female flowers. The male flower is small, 1/8 inch long, sessile, triangular, white, with three minute sepals and three larger, stiff, lanceolate petals. The stamens number six and contain very minute, colourless pollen grains. The rudimentary ovary is trifid and slightly longer than the stamens.

The female flower is 1/2 to 5/8 inch long, sessile, with three broadly imbricate green sepals, about as broad as long, and three ovate petals. At the time the flower is receptive the petals are creamy white and about 1/3 longer than the sepals. There are six minute flattened staminodes whose bases are joined together and encircle the base of the ovary. The ovary is surmounted by a thick trifid stigma which is situtated immediately below the small opening formed at the tip of the flower by the petals.

Both the male and female flowers are very fragrant.

Male and Female Flowering Phases. The male and female flowering phases are different. The male flowers commence to open at the tip of each slender male branch and continue backwards towards its base in a fairly regular manner until all the flowers are exhausted. This phase lasts from three to four weeks. Near the end of the male phase the green petals of the larger female flowers commence to lengthen and change their colour. After the last male flowers have opened, the petals of the female flowers open slightly at the top and soon after the flowers become receptive and remain so far perhaps two or three days. Although the female phase definitely starts after the close of the male phase, the commencement of it, reckoning from the time of the opening of the flowers, has been found to vary considerably in different trees. In some instances the female flowers opened the day following the close of the male phase, whilse in others up to eleven days elapsed before they opened. The average time however was about four days.

The male flowers are visited by bees and other insects but no insect visitors have been seen on the female flowers. It would appear that pollen is carried by wind and so, are normally cross-pollinated. Only under exceptional circumstances can the flowers be pollinated by pollen from the same tree. This is an important point to show the difficulty in obtaining pure races of betel-nut under ordinary conditions. It has however been observed that young trees when growing rapidly under good conditions some times develop spadices in such quick succession that the male phase of the last opened spadix overlaps the female phase of the one immediately below, so that self-pollination is possible.

The fruit takes about eight months to ripen and when ripe is orange yellow or yellow in coulour and consists of a thick fibrous outer layer, the pericarp, which encloses the single seed or nut. The hard endosperm which fills the seed is traversed by the dark wavy lines which give it a marbled appearance resembling the nut-meg. The red or reddish brown markings are due to the infolding of a dark inner layer of the seed coat into the light coloured endosperm. The embryo, situated at the base of the seed is fairly large and conical in shape. The size and shape of the fruits and nuts vary widely according to types.

Varieties. As in other cultivated plants, the betel nut palm has different types according mainly to the shape of nuts. A number of types is seen mixed in a plantation and it can be said that no plantation is of pure type. In South India we find two main types. (i) "*Siya Adike*" — *A. Catechu* — *Var. deliciosa* — not fibrous, less

tannin and smaller. (2) "*Rama Adike*" — *Actinorhytis Calapparia* — much bigger nuts, more tannin but not useful as the fresh nut is said to act as poison (5) The main type grown is the former. As betel nut palm is normally cross-pollinated and as there are numerous types in each plantation, it is difficult to decide which of these are pure types of varieties unless regular breeding experiments are conducted. The types noted in Southern India are Round Big, Round Small, Convex Shaped, Pointed Top, Narrow Base etc., according to the shape of the fruits. In Malaya Peninsula there is said to be a variety with fruits 3½ inches in length and 2¼ inches in diameter thickness — round and long fruit.

Production Practices. Areca palm is confined almost entirely to the moist tropical tracts that fringe the coast line and it is seldom found more than 200 miles away from the coast. It is often seen in moderate elevations on mountains as on the slope of the Western ghats. It flourishes well in hot, moist, rich alluvial soil and in well-drained, rich peaty soils on the slopes of hills. The main point is that it requires a rich soil which retains moisture in summer and is well drained to drain off excess water in the rainy season. "A suitable piece of land is one which lies in a valley in the malnad and under a tank or in a fertile area in the fields of the maidan tract" (5).

Seed Selection. At present seeds for planting are selected by observing the following points :

(i) Strong and vigorous trees which are 30 to 40 years old or even older are chosen as seed parents.

(ii) The embryo of the nut must be small and exactly in the centre of the nut.

(iii) The nut should be medium with a fairly large quantity of tannin.

(iv) The shell must be thin, apex pointed and the bunch large.

(v) Nuts are selected from bunches that mature in November. (5)

It is also said by experienced ryots that oval round nuts should be selected from old trees which are regular good bearers.

Nursery. The seed nuts are gathered when fully ripe, dried for a day or two and then planted in well-manured, raised beds close to one another. It takes about 1½ months for the nuts to germinate. After three months from planting they are transplanted in well-manured nurseries 1′ x 1′ or 1′ x 1½′ according to the time they are to be kept in the nursery.

Planting. Pits (2 feet cube) are generally dug in summer 8' x 8' or 8' x 10' apart and left for weathering for about a month. Well rotten cattle manure and green leaves are put into the pits and covered up. Drains, bunds and irrigation channels are all made to suit the particular plot of land. Plants, 1½ to 3 years old as required, are planted in August—September.

After Cultivation. The plantations are given a yearly digging in August. Cattle manure and green leaves are applied liberally to individual trees, and drains and bunds repaired regularly.

Irrigation. It is a regular practice to irrigate the crop in most of the areas of South Kanara and in Mettupalayam but the palm is grown without irrigation throughout Malabar. This is one of the reasons for the poor yield in Malabar compared with that in South Kanara. Where irrigated, regular irrigations are given once in 15 days throughout the life of the plantation.

Yields. The harvest of the nut is done by climbers who are experts in climbing these palms and jumping from tree to tree. Yield of nut varies according to the region, the nature of the nuts harvested, the curing practices adopted etc., It ranges from 5 cwts. to 20 cwts. per acre, the average for South Kanara 2½ candies or 1400 lbs. of air dry nuts. The trees flower in about 6 years and normal yields are gathered from 8th to 10th year. The economical life of a tree is considered to be 40 years in South India. The tree is however said to live up to 75 years.

The flowering starts in January and the harvest begins in July–August and continues upto January. In the Malnad area of Mysore each tree gives two to three bunches on an average i. e., 800 to 1000, bunches per acre. Each bunch carries 200 to 250 nuts and so the total number of nuts will be 1,50,000 or 2,00,000 per acre. About 7,000 green nuts go to make one maund (28 lbs.) of the prepared product. Thus the yield per acre is 20 to 28 maunds (560 lbs. to 784 lbs.) of cured nuts. In South Kanara three to four bunches can be taken as the average giving 240,000 to 3,20,000 nuts per acre, the cured product being 1,200 to 2,240 lbs. per acre, as here the curing is of ripe nuts. Good yields are obtained in Mettupalayam where 3,50,000 nuts are obtained to give 1,000 lbs. of cured nuts (tender nuts cured). Milsum (1926) states "The mean yield of air dry nuts is 5·4 lbs. per palm in Malaya in an experimental farm at Serdang, the yield varying from 2·5 lbs. to 8·7 lbs. whereas on hill

quartzite soil the yield of 1·5 lbs. per palm is the highest obtained (10 year old palms.) The average weight of a fresh fruit varies from 30 gms. to 78·5 gms. while the weight of the air dry nuts varies from 5·1 gms. to 14·6 gms. This shows the wide variations in the size of the nuts and the proportion of the pericarp. The yield of the fresh fruits is from 19 lbs. to 49 lbs. per tree, the percentage of air dry nuts being 13 to 24 % the average of fresh nuts being 32 lbs. and the average percentage of dry nuts being 17 %.

The heights of trees of all the types or varieties were measured 10 years after planting. Average height of the palms is 30 feet from ground level to the base of the petioles and a further 10 feet to the apex of the young leaves. Thus the average growth increase in these palms has been 4 feet per annum (6)

Inter crops and Mixed crops. It is usual to see other crops grown in areca gardens in Mysore and South Kanara where bananas are planted practically during the first year itself, in the alleys of the areca palm. About 400 suckers go per acre. In Mettupalayam banana is planted about 6 months earlier than the actual planting of the areca 8 feet apart and they are completely removed after 2 to 3 years and the areca garden is thereafter kept pure and clean When banana is grown, a fair return is got from this crop, but the first bearing of the areca palm is delayed even up to 10 years, as the palms tend to grow slender and tall due to the shade of the banana crop. Even in old plantations in South Kanara banana is grown continuously as an inter crop. Pepper, betel vine and cardamom are also grown mixed in areca gardens. It is usual to grow coconuts, jack and bread fruit on the boundaries of areca gardens to provide wind breaks and shade to the garden as well as to give a further income from the yield of these trees. The economics of growing these crops as against a pure crop of arecanut is yet to be worked out.

Inter planting of arecanut in existing gardens or orchards is a common practice. As the trees die in areca groves, young seedlings are planted to fill up the gaps, and thus gardens of hundreds of years old are found in South Kanara with trees of different ages in the same plantation.

Curing. One of the main items of work in the cultivation of arecanut is the curing of the nuts for the market. It is either done by the merchants as in Mettupalayam and Malabar or by the cultivators themselves as in South Kanara. The process of curing

depends on the market to which the nut is to be exported. In Northern India, ripe, sun dried nuts are required, whereas tender processed nuts are preferred in the South. In South Kanara ripe nuts preserved in water are also largely used. There is no definite grade or standard for the cured procuct; the same kind of product is called by different names in different localities. The main methods of curing in some of the localities in the South are given below :—

Mettupalayam. Green nuts about a month before they are fully ripe are shelled whole by knife. The very ripe and too tender nuts are separated. The nuts are then cut into two halves cross-wise (harder nuts cut into four bits length wise) and boiled just covered with hot water. When the water just begins to boil which takes about 15 minutes the nuts are removed and immediately dried in the sun for a day. They are then coloured with a mixture of 1/4 part of syrup of decoction of areca and one part of one day's decoction, and dried again in the sun for three days. This product is called '*Kalipaku*'.

"*Dottepaku*" are the hard nuts cut into four pieces and cured as above.

"*Kurune*" are the tender whole nuts boiled, scooped out, dried, and treated with decoction as above and dried again.

The decoction is boiled for three days till a syrupy consistency is got and this is tinned and sold for preparing dyes and for use in tanning.

Malabar. At least 12 different varieties of cured nuts are known in this district:

1. *Aylam.* Tender nuts are husked, sliced and dried but not boiled. Under this there are the following according to the size of the nuts :
(i) *Mullanki viravu* (ii) *Viruvu* (iii) *Mankapodi* (iv) *Ammanakri* (v) *Chitianam* (vi) *Poochittanam.*

2. *Nayam.* Nuts which are sliced thin and dried but not boiled.

The following are the sliced and boiled varieties :

3. *Levangacheer.* Cut into four longitudional splits.
4. *Nukkalcheer* Do. six do.

5. *Edua Cheer.*	Cut into more than six longitudional splits.
6. *Podichoor.*	Cut into finer bits.
7. *Mudichoor.*	Cut into finest possible bits (not generally made but to order).
8. *Ottavettu*	Cut into cross wise once. If the nuts are long, the central bit is taken out and only the two ends are left.
9. *Kuttnpude.*	Central bits of the long nuts.
10. *Alaku.*	Is No. 9 treated twice with "*Kali*" (Syrup or the boiled decoction).
11. *Krassl.*	Thinnest boiled nuts — one nut cut across into 80 slices.

South Kanara. The nuts are allowed to ripen fully on the tree. When fully mature and yellow, they are dried contionously in the sun till the nuts rattle inside the shell. They are then shelled and marketed as such without any definite grading.

Diseases and pests. "*Koleroga*" or "*Mahali*" caused by *Phytophthora Parasitica — var. arecae —* is the important one. It is found tc cause considerable damage in heavy rainfall tracts as in bad attacks the whole crop is seen to shed in the tender stages. *Control :* In North Kanara "*Kotte*" tying by means of small cover made of areca leafsheath or hillgrass dipped in Bordeaux mixture is being adopted to protect the bunches from rain and thus prevent attack of the fungus. It is not found as effective as spraying with Bordeaux mixture. It is practically controlled by adopting sanitary measures by destroying all the affected parts and then spraying with 1% Bordeaux mixture once just before the South West Monsoon and again after 1½ to 2 months. A third spraying may be necessary if the rainfall is very heavy. Large areas are now being protected in South Kanara and Mysore by these regular sprayings. The arecanut gardens in Mettupalayam and some parts of Malabar are free from this disease,

2. "*Anaberoga*" causen by *Ganoderma lucidus*. This is found in Mysore but is not serious (5) It is a wilt which infects the roots, proceeds up to the stem and causes wilting. Brackets develp on the side after the trees die. The tree should be cut off. Incorporating sulphur round the surrounding trees at half a pound per tree is also advised. In order to avoid-soil borne infection brackets should not be allowed to develop on the dead tree.

3. The stem-bleeding disease is caused by *Thielaviopsis* or *Ceratostomella) Paradoxa.* The removal and burning of the affected part is advised. Shading from South West aspect of the sun may be advantageour.

4. Band disease is found in Bombay. Nothing is done to control this at present. It appears to be physiological.

5. A new root diseas is being seen in parts of the Travancore and Cochin. It is found to be highly contagious and work on its control is yet to be done. Attention to cultural operation coupled with manuring and liming are said to be desirable.

Cost of Cultivation. The following gives a rough idea of the cost of cultivation of arecanut in South Kanara District in 1946:—

Particulars.	*Malnad area.* Rs.	*Non-Malnad area.* Rs.
1. Cost of raising & upkeep of the areca plantation up to 5 years till the crop comes to flower.	1,030—0—0	880—0—0
2. Amount realised by sale proceeds of catch crops during the period	600—0—0	750—0—0
3. Net cost per acre for 5 years	430—0—0	130—0—0
4. Cost of land per acre	1,000—0—0	2,000—0—0
5. Total cost per acre	1,430—0—0	2,130—0—0
From the fifth to the eight year, the cost of cultivation will be met by the produce.		
6. Cost of the upkeep of the garden per year after the 8th year ...	360—0—0	288—0—0
7. Interest on capital	85—0—0	127—0—0
Total cost ...	445—0—0	415—0—0
8. Estimated value of yield at 2½ candies in Malnad area and 3 candies in Non-Malnad area at Rs. 400/- per candy of 560 lbs.	1,000—0—0	1,200—0—0
Net profit per acre	555—0—0	785—0—0

The price of nut at present is Rs. 520/- per candy and the net income therefore is much more. Further, an income of Rs. 100/- per acre is expected from other crops like banana, pepper, Jack etc., from the garden. The cost of cultivation varies with the localities and the nature of land.

Summary. The origin of the areca palm is not an agreed point. It is taken to be Malaya and the Philippine group of island.

2. The value of production of arecanut is more than 5½ crores of rupees in the Madras Presidency alone and thus it is an important commercial crop of South India.

3. The description of the plant and floral parts is recorded. It is a crop which is cross-pollinated and thus a number of different types is found mixed in the same locality. The main types are indicated.

4. An idea of the cultivation of the palm is given.

5. The curing methods and the names and grades of different cured products are found to vary widely. A brief description is given.

6. Different diseases on the palm are noted with their control measures. "*Mahali*" at present is found to be the most destructive.

7. The inter-crops grown are noted and the benefit or otherwise of the same is yet to be worked out.

8. A rongh idea of the cost of cultivation and the net profits per acre is given.

9. The importance of taking up the improvements of the crop immediately is brought out.

Conclusion. As there is not much precise data available on arecanut, this paper has been mostly compiled from figures and observations collected from various sources and through personal enquiries.

Betel nut industry is of considerable capable extension and it is estimated that 80% of the people of India are consumers of betel nuts. We are spending a large amount on the import of this product from outside. It is possible to increase both the area and the production of the existing gardens by careful scientific improvements and it is, therefore, necessary and urgent that this question is taken up immediately.

The following are the most important points to be considered in the improvement of the arecanut.

1. Selection of seed nuts: As already shown under the description of the palm, this being a cross pollinated crop, pure types are not found in any of the existing gardens. It is, therefore, necessary to evolve a definite programme of breeding work to select and breed the best and the promising types.

2. Till pure strains are evolved through breeding, a beginning has to be made to select the best gardens and mark out individual groups of trees for the purpose of distribution of seedlings of known merit.

3. There is no definite data available on the proper cultivation, manuring etc., of the crop. It is, therefore, necessary to record in detail the local practices and thus evolve a standard method till research on this point is carried out.

4. Regular and definite control measures against diseases should be done to control and eradicate diseases.

5. The best intercrops to be grown, the period up to which they are economic and beneficial, should be found out by investigation.

6. It is seen at present that rows of trees facing the southern sun are generally affected and sun-burnt, the stems af these trees becoming burnt and hollow on one side. Investigations should be directed towards finding out the best shade trees (no tree is found to grow as quickly as *Areca catechu* except perhaps *Casuarina*, which requires a sandy light soil) or whether a thick belt planting of areca itself on the southern side will protect the garden from sun-burn.

7. The curing of the nut is an important aspect where standard methods are yet to be evolved. More careful preparation of the product to suit the markets would still further enhance the market prices. Small machinery to dehusk the nuts will have to be devised.

8. Grading and marketing of the product should be improved and regularised. It is seen at present that a large margin of the profits is taken away by the middlemen and it is time that regulated markets are established for the sale of arecanuts.

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The Role of the Meteorologist in a Scheme of Grow More Food Crops

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The meteorologist has an important role in crop production where success depends upon a knowlenge of the weather conditions. This is particularly so in controlling pests and diseases. The Entomologist will work out the detailed life histories of particular insects in relation to the manner of damage and method of control. The Mycologist again may be ready with a prescription for the control of fungi. But it has been brought to light from recent investigations that the periodicity and virulence of pests and diseases are intimately connected with the prevailing weather conditions. Thus the meteorologist will be of immense help to these scientists with the forecast of weather conditions in advance to forearm them with suitable methods of control.

India is not wanting in intelligent farmers. In fact in every language there are sayings connecting the influence of weather conditions with the performance of cultivated crops. A thorough collection of all of the local 'folk lore' connected with weather and careful analysis of the same will certainly give one an insight into the influence of weather on crop growth. If the ideas behind them are scientifically scrutinised and interpreted, it should be possible to guide, with confidence, the agricultural operations in any particular locality.

Crop growth is a matter of applied physiology under the influence of the reaction of the crop to its meteorological environment. The extent of the reaction depends on the stage of development of the plant and the intensity of the major meteorological factors. Rainfall affects the crop directly and also indirectly by altering the surrounding temperature and the atmospheric humidity. The limit to which the changes in the temperature and the atmospheric humidity affect the crop depends on the length for which these factors are in operation. With the help of the thermographs and hygrographs or combined thermohygrographs one can get an idea of the periodic changes in temperature and humidity for working out their influence on cultivated crops from the records carefully maintained for the purpose.

If the data collected over a series of years regarding the microclimatic observations and crop observations are collated and interpreted, they will provide us useful and valuable information for our guidance.

There may be some indications of periodicity which may be helpful in reviewing agricultural practices and operations and in adjusting them to weather conditions. The sunspot is a case in point. It has also been found in many countries that there is a periodicity in the weather especially rainfall at a certain locality. Another interesting thing is the prediction of weather at a particular locality judging from the weather conditions that prevail in certain other localities. Thus it has been found that the onset of the South West Monsoon and the incidence of precipitation are governed by such trivial and remote factors as the South Rhodesian rain and Java rain and the South American pressure.

It has been computed that there is a four to one chance that the total monsoon rainfall of June to September of 1948 will be between 82 per cent and 112 percent of the normal in the Peninsula, between 79 per cent and 128 per cent of the normal in North West India and between 90 per cent and 110 per cent of the normal in North East India.

Another interesting study is Phenology, which is the science of relations between climate and periodic biological phenomena as the migratons and breeding of birds, the flowering and fruiting of plants etc. When sea birds fly out early and far to seaward, moderate wind and fair weather may be expected. When they hang about the land or over it, sometimes flying inland, strong wind with a stormy weather may be anticipated. As many creatures besides birds are affected by the approach of rain or wind, such indications should not be slighted by an observer, who wishes to forsee weather. For example, dragon-fly flying low, winged ants seen in large numbers, birds taking shelter in a hurried manner are some of the indications of impending rain. Particularly a knowledge of the amount and periodicity of rainfall is essential for preparing the soil and for ensuring good and even germination of seed in the first instance and subsequently in terms of evaporation and soil water relationships as controlled by atmospheric conditions, for favouring crop growth.

The importance of history of previous occurrence of drought or deluge in a particular locality is not to be belittled. There may be a law or rule governing such an occurrence. Statistical analysis of the existing data may throw some light on that law or rule in terms of past occurrences and their frequencies. The probabilities of the future occurrences and coincidence limits may even be worked out when sufficient data are available. The occurrences of floods in Bengal and Bihar can be taken as a typical example.

Liability of India to floods, droughts and storms. A careful scrutiny of the past records will give very reliable information on the parts of the country that have been now and then subject to famine due to the failure of the rains. Occasionally even the whole country is involved in famine.

Walford has recorded 34 famines in India during the 100 years ending 1879. The years 1877, 1899 and 1918 will ever abide in our memory as disastrous famine years, mainly due to the failure of the monsoon rains.

As contrast years 1878, 1892 and 1917 are to be remembered as the years in which floods or excessive rainfall occured over a large part of the country. South Indians will remember the famous floods of the year 1924 as they will have always in mind the current year 1947–48 as the year of failure of both the monsoons.

The examination and collation of data collected over a series of years will give one very useful information on (i) whether on a scientific basis any periods or regions can be marked off in our agricultural year and country; (ii) the quantity and distribution of rainfall which may determine the success or failure of a crop in a given region; (iii) the percentage of deficiency in the normal rainfall that may be regarded as the minimum limit for a given crop in a given locality and (iv) the atmospheric conditions in relation to pests and diseases of plants.

The main role which the meteorologist will have to play will be to post the farmers with reliable knowledge of the nature and quantity of rainfall which they can expect to have at stated intervals. This takes us on to the question of forecasting of weather and organisation of weather services. A beginning has already been made by the Indian Meteorological Department for an all India interest and now and then for provincial interest also. But we have to develop this branch so that we may be able to forecast for a larger section of the people by opening a net work of observatories and thereby making a very thorough study of the elements of weather. The farmers are really interested in knowing whether, weather conditions will be such as will enable them to do timely agricultural operations and to produce a good crop during the coming season. Admittedly, in Madras Province we have not yet attained that stage as to be of some service to the farmers in this connection. It is for this lack of sufficiant information and warnings of weather that the farmers here often consult Indian almanacs which predict in some way rainfall in the light of the astronomical calculations on the position of stars and planets in relation to the Sun and the Moon. A close contact with any actual tiller of the soil will reveal two facts, namely, (i) the hopes and fears regarding the rainfall in which the majority of the farmers live and (ii) the importance which the older and experienced farmers attach to rainfall in a particular "Karthi" ... a term related to the position of constellations in the Zodiac–as a means of predicting weather and rainfall. Some of the beliefs are no doubt based on ages of experience but the majority are only popular beliefs. The local almanacs, which have a reputation in the villagés, are based on the science of astronomy. Dr. S. N. Sen of the Indian Meteorological Department in his publication in Science and Culture 1937, on "Meteorologicai Interpretation of

Kalidasa's 'Megha Duta' or cloud messenger, has stated that the knowledge of cloud movements and rain two thousand years ago is surprisingly similar to modern knowledge. It would, therefore, appear that ancient weather lore is not all trifle and that there is something in it that is worthy of scientific investigation and that too before the learned astronomers who prepare almanacs become extinct. The first thing to to be done is to ascertain whether and how far there is any agreement between the predictions ef rainfall made in the almanacs and the rainfall as recorded by the raingauges in the previous years. Such an investigation is bound to be useful. If one takes up this investigation, he will find that it offers a rich field for study of the actual weather conditions over long periods. From this point of view also collection of accurate weather data over long periods is very essential.

Conclusion. It is hoped that meteorology, which is nothing but applied physics, will very soon play as important a role as some of the applied sciences such as Agricultural Botany, Agricultural Chemistry etc. in a scheme of grow more food production. It is unfortunate that the branch of Agricultural Meteorology has been neglected so far particularly in the Madras Province. A beginning has however been made by the creation of a separate section of Agricultural Meteorology in the Agricultural Department. It is hoped that with the kind patronage of the Madras Government and able guidance of the Indian Meteorological Department, Poona, this newly created section will be able to help the farmer by codifying the weather data and issuing such warnings as are possible.

Romance of the Reborn Sugar Industry in India

By

Dr. T. S. VENKATARAMAN

[*A summary of the popular lecture which was delivered at Walchandnagar, (District Poona) on 10th February, 1949 at 6-30 p. m., during the occasion of the Eleventh Meeting of the Indian Central Sugarcane Committee*]

Though it is widely known that the Benares Hindu University owes its origin to our revered leader, Pandit Madan Mohan Malvyaji, it is within the knowledge of only a few that the rebirth of the Indian Sugar Industry was also initiated by Panditji. It was he that drew the attention of the Government of India to the deteriorating position of the home industry caused by imports of cheap white sugar from Java. At the instance of the legislature, the Central Agricultural Board initiated work in two directions. One was on the manufacturing side and consisted of trying to evolve a unit in between the modern sugar factory and *gur* manufacturing methods. To the Station at Coimbatore was entrusted the task of producing improved sugarcanes for the country. This is because the canes in cultivation over the bulk of India were easily some of the poorest in the world.

In view of the fact that canes imported from other countries were mostly failures, the station at Coimbatore attempted to produce new canes within the country by suitable breeding. At that time the opinion was strongly held both in India and outside that sugarcanes did not produce fertile seeds under Indian conditions. The first possibly sugarcane seedlings that germinated were too carefully grown and under such artificial conditions that most of them died out. An attempt was therefore made to germinate the seeds in the open and under natural conditions exposed to both the sun and rain of India. This resulted in quite a large number of germinations which gave the suspicion that they were all only grasses and not real sugarcane seedlings. The order was therefore given that they should be destroyed to prevent discredit to the attempt. Fortunately, however, a holiday intervened between the order and its execution. This enabled a reconsideration of the matter and it was decided to keep the seedlings for a couple of months but removed from public view. If ordinary grasses they would show themselves up by the time. The wells in Coimbatore are very deep and the seedlings found a lodging in the berm of these wells hidden from public view. These plants which later proved to be genuine sugarcane seedlings were thus born and grew under some form of imprisonment. This reminds one of the manner in which great men were ushered into this world. Lord Jesus was born in a manger and Lord Krishna in prison.

When the Indian Sugar Committee of 1920 visited our then chief source of white sugar namely, Java, both information and plant material were freely given to India as it was thought at the time that India could never count in the white sugar world. It was then more than half a dozen years since the Coimbatore station was started on a temporary basis and so its productions were beginning to show some promise in the experimental plots of certain provincial stations. Even so, the Committee which contained men of knowledge and experience made bold to recommend the continuance of the Coimbatore attempt.

The productions from Coimbatore had many vicissitudes during their infancy and childhood stages. Being on a temporary basis the retrenchment committee constituted at the time by Government to effect economies naturally paid its first attention to Coimbatore. Fortunately however, the canes from Coimbatore — though yet grown only in small plots — had attracted the attention of a group of sugar factories in Northern India and under European management. This was because of the enthusiasm of the Sugar Bureau under Mr. Wynne Sayer who was able to get grants from the factories for expanding this work. As hard headed businessmen had placed belief in the possibilities of the Coimbatore attempt it was easy for the Government of India to continue the station though for short period and on temporary basis.

At that time certain of the Scientists at Pusa developed a hostile attitude to the Coimbatore productions. The now famous Sir Albert Howard opined that the flowering of the Coimbatore canes showed weakness. He also mentioned that the higher yields would quickly impoverish our soils. Mr. G. Clarke who was in charge of the most important sugarcane station in the U. P. pinned his faith in the Java canes which he had imported and was pushing into the cane belt. He felt that Coimbatore could not come up to the level of the Java work and therefore practically banned the cultivation of Coimbatore cane near his station. Perhaps, the first favourable report of Coimbatore work came from distant Cuba who found Co. 281 a useful cane. The factory at Nellikuppam in South India came to know of this and obtained planting material of this cane from Coimbatore.

Apart from the above there existed a popular prejudice against these productions because they were new. Some North Indian cultivators thought that because of their flowering the Coimbatore canes would ultimately develop weakness. It was even believed at the time that *gur* from Coimbatore canes would cause impotency.

Amidst these gloomy environments credit is due to the first Tariff Board which definitely realised that there was some possibility in India to develop a strong home industry. It has to be remembered that at that time, the Coimbatore productions were practically confined to experimental

plots in Government farms. The Coimbatore canes soon spread into cultivation and easily established their superiority in the grower's fields. Planting material of certain of these canes were even stolen from experimental stations and one such cane—rejected by the Experiment Station at the time—served the industry in a remarkable way for some time. This shows that when an improvement is real it does not take much labour to put it across to the Indian Cultivator. The Deitz Lanterns now so popular in India won their way through sheer superiority.

The Coimbatore productions soon came to be known in the other sugarcane stations of the world and indents began to pour in from other sugar stations on the basis of exchange of material. To-day, the Coimbatore productions have shown their use in many parts of the world from Cuba and Peru in the West to Australia in the East. In fact, the Coimbatore work came to be known in the other parts of the world earlier than most other achievements of the Agricultural departments in the country.

If one were to examine the basic factors on which the Coimbatore work was built up these may be summarised in three words:—SINCERETY, BOLDNESS and HIGH ENDEAVOUR. From the very commencement the persons in charge of Coimbatore work concentrated their sole attention on only one object namely, the production of improved canes for India. Secondary issues of however great scientific interests were religiously eschewed to conserve the energies of the station for the main work set before it. This aspect is very important for real advance in research with a definite aim. Unfortunately, this is not always realised in the country. Again, the Coimbatore scientists pursued in their endeavour new and bold lines in their scheme of hybridization. The programmes followed were frowned upon by orthodox text book scientists. Today the Coimbatore sugarcane station has got a range of parent material comparable to and in some cases superior to the other sugarcane stations of the world. For success in the future the station needs a personnel with high enthusiasm and boldness to follow up the new and novel lines of hybridization laid down during the past three decades of its existence and freedom to carry on its work unhampered by official red tape and all it connotes. JAI HIND.

Mechanization of Agriculture

*(*Summary of Some Papers contributed to the Agricultural Economic Conference, Hyderabad, Deecmber 1948).*

Dr. V. V. Sayyanna (School of Economics and Sociology, Bombay) read a paper, showing the progress of machanization in agriculture in countries abroad, in most cases up to 1940. In the wheat belt of U. S. A. almost every farm had one tractor at least, and there were more than one in many cases. The value of the mechanical equipment increased by 2½ times between 1910 and 1930, when it was estimated at 3.300 million dollars. Under the Rural Electrification Adminstration electrical service on co-operative lines expanded in rural areas in the U. S. A. When the R. E. A. was established in 1935 only 10 percent of farms were electrically equipped. There were in 1940 June 617 co-operatives sponsored by R. E. A. It was proved that electricity could be supplied at reasonable rates in rural areas for running agricultural machinery as well as for domestic lighting and other amenities.

The U. S. S. R. had adopted machinery in her collective farms, for ploughing, sowing, threshing and harvesting on an unprecedented scale. They were supplied and repaired at the State machine tractor stations. In the prewar year 23 million hectares were ploughed, 56 million hectatares were sown and 45 million hectares were harvested by machinery.

Mechanization appears best suited to large farms, but of late there has been a movement for extending such benefits to small and medium sized farms. Manufacturers are turning out machines suited to the technical and economic needs of small holdings. Researches are directed to the construction of multi purpose tractors at moderate prices which can cater to several requirements of farmers. Co-operatives are being established among small farmers for purchase and use of machinery in common. Just before the war there were 30,000 general agricultural co-operatives doing this service in Europe. Besides there were a number of special societies formed for the purpose in Scandinavian and Baltic countries. The State subsidised the manufacturers and users of small machines.

In India so far mechanised cultivation has been attempted only by a few land owners in Gujarat, Karnatak, Central Provinces, North Bihar and Orissa. There was no planned or definite effort by individuals, private bodies or Government, to encourage the use of machinery. The attempt to use machinery on large scale is the by product of 'Grow More Food Campaign'. In 1948, 300 tractors were received from abroad and 200 more were expected from U. S. A. and U. K.

*By Mr. K. C. Ramakrishnan, who attended the Conference.

Besides, the Government of India had obtained from the U. S. surplus stores, 300 trotors, most of which have been distributed to scarcity provinces and states. In the United Provinces 45,000 acres of waste land were reclaimed. The Central Provinces Government have planned to clear 100,000 acres of *kans* infested land to bring it under wheat. The Government have decided to open a few tractor stations and make tractors available for ploughing fields at Rs. 20 per acre. In the East Punjab, large scale machanical cultivation is being encouraged for rehabilitation of refugees from West Punjab.

The Ministry of Food and Agriculture of the Government of India have drawn up a six year plan of land reclamation with the help of the tractors now in hand and by importing 1000 tractors during the next three years. Nearly six million acres of cultivable waste land can be brought under cultivation, which may add only about 2 million tons of food grains annually to India's food resources. Still there will be a shortage of one million tons to the target of 3 million tons set up by the Food Grains Policy Committee. In order to reach this figure, approximately 10 million acres of cultivable land will have to be reclaimed. Here is a rough estimate of the areas available.

Assam ...	4 million acres.	Malva Union ...	1 million acres.
Orissa ...	1 ,, ,,	Vindhya Union	500,000 acres.
Madras Agency	1 ,, ,,	East Punjab	500,000 ,,
United Provinces	1 ,, ,,	Berar ...	200,000 ,,

Mr. R. S. Basrur Mechanical Cultivation Engineer to the Government of Bombay, contributed a short note on the achievement of his section up to the end of October 1948.

Deep Ploughing ...	26,000 acres.	Terracing ...	200,000 feet.
Shallow Ploughing ...	76,000 ,,	Grading ...	1,500 hrs.
Harrowing ...	6,000 ,,	Bunding ...	100 ,,

Deep ploughing work is undertaken for eradication of weeds and reclamation of waste lands. Shallow ploughing was undertaken only when deep ploughing work was not available.

In his opinion, success of mechanization depends on (1) concentration of work, (2) maximum period of tractor operation in an area in a season and (3) minimum wastage on movements. Deep ploughing work in some areas in Karnatak and Khandesh almost gives these ideal conditions. In Karnatak tractors are employed from October to April on weed eradication work; and from May to mid-June on seasonal ploughing. Larger holdings give better ploughing results with the tractor. This type of work should be enforced by law on cultivators who have *hariali* infested areas.

Employment of tractors only on seasonal ploughing in areas entirely reliant on monsoon is not an economic proposition. The ploughing season in such areas is short, and the requirements of cultivation cannot be fulfilled unless a very large fleet is maintained in that area, which would be idle for a major part of the year and result in heavy overhead expenses. This can be minimised to some extent, if units of 200 tractors are handled by a large number of co-operative societies in the area. These tractor units, with power attachments, can be employed for pumping thrashing and transport purposes during slack season. Tractors on unirrigated tracts can be employed on seasonal ploughing practically throughout the year in areas like Belapur, Kopergaon can be undertaken as a succesful commercial enterprise.

In districts which have small holdings and very short ploughing season, it is not economic to run tractors. Mechanical cultivation has a bright future in about 10 districts of Bombay. Tractor units should be mobile and operate according to the demand of the public. The size of a unit should be 6 to 8 tractors and each should be self-sufficient for repair, maintenance etc. Government tractors should be employed in the reclamation and eradication of weeds only. Seasonal ploughing should be entrusted to private bodies and individuals, who may be encouraged by the provision of timely technical assistance, supply of spare parts, oils and lubricants. Owners should be given some technical training, so as not to rely too much on unscrupulous drivers.

On the question of a large number of light tractors or a small number of heavy tractors, the former is preferred on the score that in the event of a casualty, percentage of efficiency of the whole unit is not affected markedly and capital cost is much less. As against this, overhead charges, compared with heavier tractors for the same capacity, are heavy. Much depends on the agronomical features of the areas, e. g. it is advisable to use lighter tractors in Konkan districts, where individual holdings are small. Heavier tractors do better in an area of large holdings.

Mr. M. C. Dutt, Agricultural Engineer, Assam, had a brief note.

Reclamation of waste lands. Assam provides enormous scope for extension of cultivation on virgin lands. People are too poor to buy machinery and implements. The Government of Assam has chalked out plans to help the cultivators, organised in co-operative societies, by supplying them with tractors and implements at scheduled rates for ploughing and harrowing the lands. The Government has decided to establish a central workshop and two mobile workshops with all facilities for repairs and maintenance and advice.

Heavy tractors are used in reclamation of land with medium depth of ploughing so as to protect the land from heavy soil erosion. Bull-dozers are proposed to be employed to clear light forests, and graders on highly undulated lands. It is also proposed to put in contour bunds for safeguarding against erosion.

Mechanical cultivation of arable land. Shortage of labour has rendered cost of cultivation very heavy. Uneven rainfall leads to untimely operation in agriculture and subsequent damage to crops and poor out-turn. The soil gets hardened up which the country plough cannot tackle. The need to employ machinary for breaking up the soil quickly has been felt.

The Department of Agriculture has in the period of 6 months opened up 3 projects in the Province. The task of organisation and operation has been difficult, as the spirit of co-operation has still to be infused among farmers. Up to the end of October, only 27,000 acres have been cultivated. Operations are proceeding in other areas and about 5,000 acres more will be added in the course of the year 1948.

Mr. V. Subbarajan, Engineer, Hyderabad (Deccan) stated :—

The items that have to be taken into account for examining the economic aspect of mechanization are :—

1. Interest and depreciation.
2. Running expenses,
3. Cost of repair and service.
4. Miscellaneous charges such as transport etc.

As mechanization should be adopted only for certain agricultural operations, the comparison of costs will be limited to the following.

Tractor and bullock or manual power for land development and also for annual ploughing on large estates.

Tractor power versus bullock or manual labour.

The useful life of a tractor under field conditions may be taken at 10,000 hours of five years with 2,000 hours of working per year. On this basis the rate of depreciation will be 20 percent. The interest on capital outlay may be taken at 4 percent. Considering a 10 H. P. tractor attached with necessary ploughing equipment the cost of work will be as follows. The cost of the tractor with plough outfit will be about Rs. 35,000.

1. Interest and Depreciation per hour at 4 per cent and 20 per cent per year of 2,000 hours respectively on Rs. 35,000.	Rs. 4—3—3

2.	Running expenses per hour: 5 gallons of H. S. Diesel Oil at Rs. 1—8—0 per gallon.	Rs. 7—8—0	
	1 gallon of lubricant	3—8—0	
	Grease 2 Lbs.	2—0—0	
	Cotton waste	0—1—0	
			13—8—0
3.	Cost of repair and service per hour		2—0—0
4.	Labour and supervision charges per hour: Driver	0—8—0	
	Cleaner	0—2—0	
	Supervisory and service staff	0—8—0	
			1—2—0
5.	Miscellaneous expenses per hour		1—0—0
		Total cost per hour	21—13—3

A tractor of this type can plough ¾th of an acre in one hour in hard clay soils to a depth of 12″ to 14″. The cost per acre works out at Rs. 29—1—8, or say Rs. 29. The cost per horse-power hour works out to Rs. 0—3—6. If the same work has to be done by digging by manual power, the cost will be as follows :—

The total excavation on one acre to a depth of one foot will be 43,560 cubic feet and the cost of excavation at Rs. 0—8—0 per 100 cu. ft. will be Rs. 217——8—0 as against Rs. 29 by tractor.

An average person is expected to develop 1/10th horse power. At Rs. 1—4—0 wages for one day of 8 hours working, the cost of horse-power by manual labour works out to Rs. 1—9—0 as against Rs. 0—3—6 by tractor. Thus it will be seen that work by tractor will cost only 1/7 of what it will cost if the work is done by manual labour. It may be noted that bullock power is of no use for deep ploughing in black cotton soils infested with weeds, where hand digging or tractor ploughing is the only solution. Similarly in developed areas the cost of ploughing by tractors can be compared with that by bullock power. A pair of bullocks is expected to develop one horse-power. For shallow ploughing in medium soils, 40 H. P. tractor is considered suitable. To do the same job as a tractor of 40 H.P., 40 pairs of bullocks are required. In the appendix details of cost comparison are given, from which it will be seen that for ploughing 6″ to 8″ in medium soils, it will cost Rs. 7—8—0 per acre by tractor and Rs. 11 per acre by bullock power. Thus farm work is definitely cheaper by tractor than by manual or bullock power.

The tractors can be utilised actively for a period of 8 months, from November to June. During the period when ploughing is not possible, the tractors could be utilized for stationary purposes. The tractors are extremely adoptable power units and power may be delivered at drawbar, at a belt pulley or at the special power take off. As a stationary engine, it can be utilized for pumping, crushing and similar jobs.

Appendix

Comparison of costs by Tractors and Bullock Power.

S. No. Particulars.	Ploughing by a H. P. tractor with Mould Board Plough.	Ploughing with 40 Pairs of bullocks equivalent to 40 H. P.
1. Capital outlay	Tractor and implements Rs. 25,000	at 400 each bullock Rs. 32,000
2. Depreciation per year	5 years life Rs. 5.000	10 year life Rs. 3,200
3. Interest	4% Rs. 1,000	4% Rs. 1,280
4. Running expenses	Cost per hour :— 2 gallons fuel oil Rs. 3–0–0 ½ gallon lubrication 1–12–0 1 lb grease 1–0–0 Cotton waste 0–8–0 Cost per hr. 6–4–0 per year of 2,000 hours of working Rs. 12,500	Fodder @ 40 per month per pair of bullocks and per year for 40 pairs Rs. 19,200
5. Repair	@ Re. 1/- per hour & for 2,000 hours of working in a year Rs. 2, 2,000	@ Rs. 10 per set of implements and 40 sets Rs. 400
6. Labour charges	Driver @ Rs. 90/- P. M, & cleaner at Rs. 30/- P. M. per year Rs. 1,440	30 men for 8 months 10 men 12 months at Rs. 25/- P. M. Rs. 9,000

S. No.	Particulars.	Ploughing by a H. P. tractor with Mould Board Plough.	Ploughing with 40 Pairs of bullocks equivalent to 40 H. P.
	Total operating costs per per year including interest and deprecia-tion running expenses, repair and labour charges.	Rs. 21,940	Rs. 33,000
	Total anticipated output of work	at $1\frac{1}{2}$ acres per hour & for at 2,000 hours of working in a year Rs. 3,000-acres.	Rs. 3,000
	Cost per acre	Rs. 7·31 or say Rs. 7–8–0 per acre.	Rs. 11.03 or say Rs. 11–0–0 per acre.
	Cost per horse power	Rs. 0–4–6.	Rs. 0–6–8

3000
6000
9000

HINTS TO FARMERS

Beware of soil erosion.

The failure of crops is often attributed to the impoverishment of land brought in by continuous cropping or by precarious rainfall. But many of the cultivators are still not aware of the fact that soil erosion also plays a very important role in stealing the soil of the plant food, moisture, etc. The perpetual drain on soil by erosion depletes the land gradually of its soil fertility. When the soil erosion is long and continuous, even the skeleton of the soil-body is not left over in the land. When such a stage is reached, the soil completely loses its capacity to produce crops. The exact loss by soil erosion is beyond estimation. However according to estimate made in United States of America. *Erosion steals 21 times as much plantfood as the crops take out of the land!* The soil erosion not only steals the plantfood but also changes the physical condition. With changes in the phisical condition, water holding capacity of the soil, under ground drainage and supply of under ground water also change. All these changes eventually bring down the crop yield and bring the soil to the starving condition.

When the soil in the field is lost by erosion, no amount of other improvements can really become effective. Improved farming which consists of the supply of improved crops, application of new fertilizers and manures and use of new implements cannot be much helpful if the soil is not retained permanently in its place and in sufficient depth.

Soil erosion is therefore one of the problems which seriously confronts the South Indian cultivator. He is not, as it appears at present, sufficiently conscious of the losses to the land and himself. By soil erosion millions of tons of soil are lost every year even with the average annual rainfall of 20–25 inches, rendering the land poorer and poorer. The agricultural wealth is thus drained unrestricted.

It is a wrong notion which many have that soil wash or erosion is restricted only to places of heavy rainfall or to hilly and forest areas. But soil erosion is also very common over flat and level lands where there are some small undulations and gentle slopes. When rains are received in storms and torrents, it has no time to soak into the soil even if the land is perfectly level and flat. Again a sharp intensive shower of less than an inch falling within a few moments, causes greater havoc than a soaking rain of several inches received in small drops over a long period.

The type of erosion which is generally met with in Southern India is field erosion which is very extensive and universal. This erosion should be prevented by adopting some of the following direct and indirect methods :—

(1) Terracing and constructing small bunds across slopes.

(2) Fallow cultivation of lands such as ploughing, harrowing and sowing crops along contour lines.

(3) Opening furrows and forming ridges across slopes by ridges and scoopers.

(4) Ploughing the sloping fields with a turnwrest-plough or the one-way-plough from the lower level to the higher level across the slopes.

(5) Povision of spill-ways joining common drains and construction of weirs and aprons to allow excess storm water proving harmful to the crops.

(6) Construction of small embankments and weirs across the nalas to break the force of water and to allow deposition of silt.

(7) Provision of small tanks and ponds spread all over the country for the collection of the silt-laden water and for the stimulation of underground springs which supply water to wells.

(8) Spreading crops like groundnut, horse-gram, lab-lab, cow-gram and dew-gram or a long duration crop like red-gram give resistance to the flowing sheet of water.

(9) Turfing bunds and edges with grasses and dry rivetting with stones, wherever necessary for protection.

(10) Application of silt and soil, cattle-manure, composts of organic matter ploughing in green manure crops and cultural operations tend to absorb and retain moisture thereby preventing soil erosion to some extent.

(11) Allotting a portion of the cultivated area for pasture with trees planted here and there can also control the run-off water and save soil erosion. Such pastures can be broken and crops cultivated in rotation.

The methods to be adopted and their cost depend much on the locality and individual cases. A joint scheme of terracing and bunding of fields in a village can be achieved by the co-operation of the cultivators. Similarly construction of weirs, aprons, dry rivetments, digging of common drains, cross-bunding of nalas, provision of tanks and ponds for trapping water and silt are possible only by co-operation.

The experiments conducted for the past 4 or 5 years in the dry farming of the Bellary black soil go to show that an average extra annual net income of Rs. 6 per acre can be got by bunding.

[Villagers' Calendar, Govt. of Madras]

Abstract.

The importance of studying the cytogenetic effect of the various insecticides and fungicides which are being used to protect crops against insect pests and diseases appears not to have been sufficiently recognised by cytogeneticists and plant breeders. Though the best insecticides and fungicides are those which kill the plant parasites without affecting the plant organism some of them have been found to affect the host plant in various ways and degrees. Thus for example ethyl mercuric chloride which is the active substance of the fungicide "Granosan" induces atypical growth, abnormal mitosis and polyploidy. Almost similar effects have been seen in the case of Hexachlorocyclohexane (666) which has of late found widespread use as an insecticide. Hexachlorane stimulates the germination of certain *cruciferae* initially, but the growth of such treated seedlings become strikingly suppressed later on.

Cytological studies of the roots of a number of plants treated with insecticides containing hexachlorocyclohexane have revealed that the agents cause disturbances in the mitotic processes by acting upon the cytoplasm and interfering with the cytoplasmic processes involved in the formation of achromatic bodies. The continuance of such disturbances leads to the production of tetraploid, octoploid, and even cells of much higher degree of polyploidy. Certain changes in the nuclear elements have also been induced by the active agents. The changes resemble those induced by colchicine, acenaphthene and other polyploidizing agents. Two features however are worth noticing; one is that the tissue is affected only if the particles are in contact with it unlike in the case of acenaphthene; the other is that meiotic processes are practically unaffected.

Insecticides and fungicides which induce disturbances of the sorts mentioned above, "when applied, may increase the hereditary changes in the cultivated "pure lines" leading thus to more rapid degeneration of the highly bred uniform varieties. This means that when one applies such insecticides or fungicides one should more frequently change the seeds of the varieties which he propagates, by using a fresh non-degenerated stock."

(Cytogenetic changes and atypical growth induced by Hexachlorocyclohexane $C_6 H_6 Cl_6$) by Dontcho Kostoff; *Current Science,* 17: 294–5).

Agricultural College and Research Institute Library, Lawley Road, Coimbatore.

MONTHLY LIST OF ADDITIONS FOR MARCH 1949

1. BELL (G. D. H.): Cultivated plants of the farm. 1948
2. DETURK (E. E.) Ed: Freedom from want, a survey of the possibilities of meeting the World food needs.
3. EMERSON: Basic Botany. 1947
4. FREAR (D. E.): *Comp:* Catalogue of insecticides and fungicides. 1943
5. HUTCHESON (T. B.): *etc:* Production of field crops; a text book of agronomy. 1948
6. HYLANDER (C. J): Plants and man. 1947
7. COSTING (H. J.): Study of plant communities an introduction to plant ecology. 1948
8. PATIL (P. K.): Food problems in general and in Kolhpur State in particular. 1948
9. TOTHILI (P. K.): *Ed:* Agriculture in the Sudan. 1948
10. UNWIN (J. D.): Our economic problems and their solution. 1948
11. VOGI (William): Road to survival. 1949
12. HUTYRA (Franz): Special pathology and therapeutics of the diseases of domestic animals edited by J. Russel Greig and J. R. Mohlor in 3 V. 1946
13. SOIL CONSERVATION—an international study by F. A. O. Agricultural Studies No. 4. 1948

Crop and Trade Reports

Statistics — Crop — Paddy 1948 — '49 — Third or Final Forecast Report

1. The average area under paddy in the Madras Province during the five years ending 1944—'45 represents 13·3 percent of the total area under paddy in India.

2. The area sown with paddy in 1948—'49 is estimated at 10 229,000 acres as against 10,352,000 acres estimated for the corresponding period of the previous year and the finally recorded area of 10,434,149 acres in 1947—'48 according to the season and crop report The present estimate shows a decrease of 1·2 percent as compared with the corresponding estimate of the previous year and of 2·0 percent as compared with the final area for the previous year.

3. When compared with the final area of last year, an increase in area is estimated in the districts of West Godavari, Krishna, Bellary, Nellore, Tanjore, Ramnad, Tirunelveli and Malabar. and a decrease in area in all the other districts of the Provinc except the Nilgiris, where the area is expected to be the same as that of last year. The decrease which is marked in the districts of Anantapur, Cuddapah, Chingleput, South Arcot, Chittoor, North Arcot and Salem, is due to late and inadequate receipt of rains during the sowing period and insufficient supplies of water in irrigation sources.

4. 1,326,000 acres have been reported as sown since 1st December 1948, made up of 229,000 acres in the Circars, 90,000 acres in the Deccan, 252,000 acres in the Carnatic, 280,000 acres in the Central Districts, 439,000 acres in the South and 36,000 acres in the West Coast and the Hills. The area sown since 1st December 1948 was higher than that sown in the corresponding period of the previous year by 337,000 acres or by 34·1 per cent.

The area under second crop paddy is expected to be below the normal in the Carnatic and the Central districts as a result of the failure of the North East Monsoon rains and the consequent inadequacy of supplies of water in irrigation sources. Ploughing of wet lands on a large scale for raising second crop has been delayed or suspended in parts of Chittoor and North Arcot districts. In the Malabar and South Kanara districts the area under second crop is reported to be above the normal due to favourable seasonal conditions.

5. The harvest of the main crop of paddy is in progress. The yield per acre is expected to be normal only in the South Kanara district, and below the normal in all the other districts of the Province, due partly to untimely heavy rains received at the time of flowering in the Circars districts, and partly to the failure of the North East Monsoon rains in the Carnatic, the Central districts and parts of the South and the damage caused by attacks of insect pests. As the result of the failure of seasonal rains and the consequent inadequacy of supplies of water in irrigation sources, the crops sown early in the season in the districts of Anantapur, Cuddapah, Chingleput, South Arcot, Chittoor, North Arcot and parts of Ramnad have been severely affected by drought. The crop also suffered damage due to attacks by insect pests which increased considerably during December 1948 and January 1949. Attacks by pests were reported in two taluks in Cuddapah district, four taluks in Chingleput district, parts of South Arcot district, three taluks in Chittoor, almost all taluks in North Arcot, seven taluks in Salem, four taluks in Coimbatore, all taluks in Tiruchirapalli and parts of the Tanjore, Madura and Nilgiris districts Failure of crops is reported to have occured on a fairly wide scale in the Chingleput and South Arcot districts, and to a lesser extent in parts of Kurnool, Anantapur, Cuddapah, Chittoor, North Arcot, Salem, Tiruchirapalli and Ramnad districts.

The seasonal factor for the Province as a whole works out to 81 per cent of the normal as against 82 per cent in the season and crop report of the previous year. On this basis the total yield is estimated at 4,208,000 tons of cleaned rice as against 4,330,000 tons of rice estimated in the season and crop report of the previous year, representing a decrease of 2·8 per cent.

6 The average wholesale price of paddy II sort, per imperial maund of 82 2/7 lbs. (equivalent to 3,200 tolas) as reported from important market centres on 19th February 1949 was Rs. 10—8—0 in Virudhunagar, Rs. 10—4—0 in Vizianagaram, Rs. 9—6—0 in Cuddalore, Rs. 9—4—0 in Kakinada and Mangalore, Rs. 9—2—0 in Mathurai Rs. 8—15—0 in Masulipatam, Rs. 8—13—0 in Guntur, Rs. 8—8—0 in Kumbakonam, Rs. 8—6—0 in in Vellore and Tiruchirapalli, Rs. 8—2—0 in Nagapatam and Rs. 8—1—0 in Eluru. when compared with the prices published in the previous report i. e., those which prevailed on 15th January 1949, these prices reveal a rise of approximately 17 per cent at Virudunagar and have remained stationary in the other centres.

Sub :— Statistics—Crop—Groundnut—1949—First Report.

The area sown with summer or irrigated groundnut during the three months (January to March—1949) is estimated at 53,200 acres. When compared with the estimated area 57,100 acres for the corresponding period of last year there is a decrease of 6·8 per cent due mainly to failure of rains.

The Wholesale price of groundnut (Shelled) per Imperial Maund of 82 2/7 lbs. (equivalent to 3,2000 tolas) as reported from important market centres on 9th April 1949 was Rs. 28—5—0 in Coimbatore, Rs. 26—8—0 in Nandyal, Rs. 26—5—0 in Hindupur, Rs. 26—3—0 in Cuddalore, Rs. 26—1—0 in Salem, Rs. 26—0—0 in Guntur Rs. 25—14—0 in Adoni, Rs. 25—9—0 in Tadapatri, Rs. 24—5—0 in Erode, and Rs. 23—8—0 in Cuddaah. When compared with the prices published in the previous report i. e. those which prevailed on 8—1—1949 these prices reveal an increase of 21 per cent in Hindupur 20 per cent in Cuddalore, 19 per cent in Nandyal, 18 per cent in Coimbatore, 15 per cent in Adoni and Tadpatri, 10 per cent in Salem, 7 per cent in Guntur, and 3 per cent in Erode. (From Public and Economics Statistics Dept.)

Cotton Raw, in the Madras Province: The receipts of loose cotton at press on and spinning miles in the Madras Presidency from 1st February 1949 to 8—4—1949 amounted to 29,246 bales of 392 lb. lint as against an estimate of bales of the total crop of 1948—'49. The receipts in the corresponding period of the previous year were 68,041 bales. 102,585 bales mainly of pressed cotton were received at spinning mills and 1655 bales were exported by sea while 38,471 bales were imported by sea mainly from Karachi and Bombay. (From Director of Agriculture)

Weather Review—For March 1949.

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	Nil	—0·6	Nil
	Calingapatam	Nil	—0·4	0·3
	Vizagapatam	Nil	—0·5	0·4
	Anakapalle*	Nil	—1·0	0·2
	Samalkot*	Nil	—0·8	Nil
	Kakinada	Nil	—0·5	0·1
	Maruteru*	Nil	—0·5	Nil
	Masulipatam	Nil	—0·4	Tr.
	Guntur*	Nil	—0·8	Nil
	Agri. College, Bapatla	...	...	...
	Veeravanam (College Farm)	...	...	...
Ceded Dists.	Kurnool	Nil	—0·2	Nil
	Nandyal*	Nil	Nil	Nil
	Hagari*	Nil	—**	Nil
	Siruguppa*	Nil	—0·2§	Nil
	Bellary	Nil	—0·2	Nil
	Rentichintala	Nil	...	Nil
	Cuddapah	Nil	—0·2	Nil
	Anantharajpet*	Nil	—0·5	Nil
Carnatic.	Nellore	Nil	—0·2	Nil
	Buchireddi-palem*	Nil	...	Nil
	Madras	Nil	—0·3	Nil
	Tirurkuppam*	Nil	—1·5$	Nil
	Palur*	Nil	—0·6	Nil
	Tindivanam*	Nil	—0·7	Nil
	Cuddalore	Nil	—0·7	Nil
Central.	Vellore	Nil	—0·3	Nil
	Gudiyatham*	Nil	—0·4	Nil
	Salem	Nil	—0·5	0·1
	Coimbatore (A. C. R. I.)*	Nil	—0·3	0·1
	Coimbatore (C. B. S.)*	Nil	—0·5	Nil
	Coimbatore	Nil	—0·5	Nil
	Tiruchirapalli	Nil	—0·4	Tr.
South.	Negapatam	Nil	—0·8	0·5
	Aduturai*	Nil	—0·5	Nil‡
	Pattukottai*	Nil	—1·4	0·4
	Mathurai	Nil	—0·7	0·9
	Pamban	Nil	—0·7	6·2
	Koilpatti*	Nil	—1·5	1·9
	Palamcottah	Nil	—1·0	1·0
	Amba-samudram*	Nil	—2·2	1·2
West Coast.	Trivandrum	Nil	—1·5	0·3
	Cochin	0·3	—1·7	0·3
	Calicut	0·1	—0·3	0·1
	Pattambi*	Nil	—0·9	Nil
	Taliparamba*	Nil	—0·5	Nil
	Nileshwar*	Nil	—0·3	Nil
	Pilicode*	Nil	—0·6$	Nil
	Mangalore	Nil	—0·5	Nil
	Kankanady*	Nil	—0·6	Nil
Mysore & Coorg.	Chitaldrug	Nil	—0·2	Nil
	Bangalore	Nil	—0·4	0·3
	Mysore	Nil	—0·5	Nil
Hills.	Mercara	Nil	—0·8	0·1
	Kodaikanal	Nil	—1·8	1·0
	Coonoor*	Nil	—1·7	Nil
	Ootacamund*	Nil	—1·4	Nil
	Nanjanad*	Nil	—1·1	Nil

Note:— (1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal.

(3) $ Average of six years data for Tirurkuppam, and seven years for Pilicode is given as normal.

(4) § Actual figure is 0·03".

(5) $ Taluk office rainfall is Nil

(6) Tr. Trace, i. e., Rainfall below 0·04".

(7) ... Figures not available.

Weather Review for March 1949.

The western disturbance noted in the region of Punjab and the West United Provinces in the first week of March 1949 caused local showers in and near the hills of the Eastern Punjab and the West United Provinces.

This western disturbance induced towards the later half of the first week a secondary over Madhya Bharat and Vindhya Pradesh. This secondary caused a shallow 'low' over Chota Nagpur, South Bihar and the adjoining areas and this 'low' became less important the very next day. Even then it caused fairly widespread thundershowers in Upper Assam and a few thundershowers in Orissa, Gangetic West Bengal and Chota Nagpur.

Sind and the adjoining areas were under the effects of a western disturbance in the second week of the month under report. Punjab and the near-about regions experienced a number of shallow 'lows' and fresh mild western disturbances.

During the first ten days in the month, temperatures were generally below normal in Rayalaseema, Andhradesa and parts of Tamilnad. On 5—3—1949 and 24—3—1949 mist or fog occurred locally in the morning over Mysore Plateau. In the latter portion of the first fortnight and the subsequent days the day temperatures happened to be above normal and night temperatures were fluctuating, particularly in Andhradesa. Cuddapah was recording a high temperature of 106° to 107° for about four days from 14—3—1949.

The rainfall statement given above would show that rainless weather was experienced throughout the Madras Presidency barring the solitary exception of Cochin, which recorded only a total precipitation of 0·3".

M. B. V. N. & C. B. M.

Departmental Notifications

GAZETTED SERVICE—POSTING AND TRANSFERS

Name of Officers	From	To
Sri Balasubramanian, R.	On leave,	Cotton Specialist and Vice-Principal, Agricultural College and Research Institute, Coimbatore.
„ Jagannatha Rao, C.	Cotton Specialist, Coimbatore,	Superintendent, A. R. S., Hagari.
„ Subramania Pillai, M.	D. A. O., Nellore,	Regional Dy. D. A., Ellore.
„ Subramania Sarma, A. H.	Assistant Marketing Officer, Coimbatore,	Gazetted Assistant in Agriculture, Agricultural College, Coimbatore.
„ Sadagopan, V.	D. A. O. (on leave),	Assistant Marketing Officer, Coimbatore.
„ Suryanarayana, V.	D. A. O. (on leave),	Gazetted Assistant in Agriculture, Agricultural College, Bapatla.

SUBORDINATE SERVICE

APPOINTMENTS

The following are appointed as Upper subordinates in the Madras Agricultural Subordinate service under Rule 9(a) (i) of the General Rules (Emergency Provisions):—

Sri Anantha Rao, A.	Assistant, in millets, Coimbatore.
„ Chandaiiah Naidu,	Farm Manager, Sugarcane Liaison Farm, Hospet.
„ Jagannadha Rao, P.	Assistant in Millets A. R. S. Koilpatti.
Dr. Govindaswami, P. S.	Teaching Assistant in Economics, Coimbatore.
Sri Satyanarayan, S. B.	A. D., Ichapur.

POSTING AND TRANSFERS

Name of Officers	From	To
Mr. Azariah, M. D.	F. M., A. R. S., Wellington,	F. M., A. R. S., Nanjanad.
Dr. Bashu Saheb,	A. D., Dersi,	A. D., Koilkuntala.
Sri Bangarayya, M.	F. M., A. R. S., Anakapalle,	Assistant in Mycology, Coimbatore.
„ Doraiswami, K.	F. M., A. R. S., Palur.	Special, A. D., Cuddalore.
„ Govindan Nair, K. V.	F. M., A. R. S., Nileshwar,	Assistant in Oilseeds, Nileshwar.
„ Habibullah, K. S.	A. D., Chicacole,	Special A. D., Viravalli.
„ Jayaraman, M. V.	A. D., Arni,	Assistant in Meterology, Coimbatore.
„ Krishnaiah, V. V.	A. D., Gudur,	P. P. A., Cuddalore.
„ Kulandaswami, M. S.	A. D., Musri,	Special A. D., Karur.
„ Kulasekharan, C. R.	Special A. D., Ayyangudi,	A. D., Vridachalam.
„ Krishnaswami Ayyangar, M.	Assistant A. D., Rayachotti,	Assistant A. D., Vegetable Scheme, Madras.
Miss Kunjammá Daivy,	Dairy Manager, Coimbatore,	Assistant in Millets, Coimbatore.
Sri Krishnamurthi, K.	F. M., A. R. S., Samalkota	Assistant in Agronomy, Anakapalle.
„ Krishnamurthi, V.	Assistant in Mycology, Coimbatore,	A. D., Tirukoilur.
„ Krishnamurthi, M. R.	A. D., Vridachalam,	Special A. D., Virdachalam.
„ Krishnamurthi, G.	A. D., Vegetable Scheme, Madras,	A. D., Avanigadda.
„ Krishnaswami Rao, T. B.	Assistant in Mycology, Coimbatore,	A. D., Avanashi.
„ Kamath, H. N.	A. D., Coondapur,	Special A. D., Coondapur.
„ Lakshminarayana Rao, K.	F. M., Siruguppa,	Assistant in Cotton, Adoni.
„ Lakshmipathi Rao, T.	On leave,	Special A. D., Ramachandrapur
„ Lakshmipathi Rao, S.	A. D., Punganur,	Special A. D., Punganur.
„ Mohmad Baig,	A. D., Hindupur, (on leave),	P. A., to D. A. O., Anantapur.
„ Muthukumarappa, S.	P. P., Assistant, Coimbatore,	A. D., Sugarcane Scheme, Villuppuram.
„ Meenakshisundaram, M. N.	A. D., Tinnevelly,	Special A. D., Nilakottai.
„ Muthuswami, S.	Assistant in Fruits, Coonoor,	Assistant in Banana Research Station, Maruthanakudy.
„ Madhava Ayyar, S.	A. D., Tanjore,	A. D., Cuddalore.

	Name of Officers	From	To
Sri	Madhava Rao, S.	Assistant in Paddy, Coimbatore,	Special A. D., Crop Cutting Exporters, Vellore.
,,	Narasimha Ayyar, B. S.	Assistant Agricultural Chemist, Coimbatore	Assistant in Chemistry, Compost Scheme, Coimbatore.
,,	Nagabushana Rao, Y.	A. D., Narasapatam,	Special A. D., Grawavaram.
,,	Natesa Ayyar, P. K.	A. D., Avanashi,	Special A. D., Coimbatore.
,,	Narasimhamurthi, G.	A. D., Siruguppa,	Special A. D., Hospet.
,,	Narasimhamurthi, B. L.	Assistant in Millets, Anakapalle,	Assistant in Millets, Narasaropet.
,,	Narayana Reddy, B.	A. D., Hindupur,	Special A. D., Hindupur.
,,	Narasimhalu, K.	A. D., Vayalpad,	Special A. D., Chittoor.
,,	Rangaswami, G.	Assistant in Mycology, Coimbatore,	Assistant in Mycology, Kalpatta, Wynad.
,,	Rajagopalan, K.	Assistant in Chemistry, Coimbatore,	A. D., Namakkal.
,,	Ramanarai, K. S.	A. D., Crop Cutting Experiments, Calicut,	Special A. D., Mangalore.
,,	Radhakrishna Reddy,	A. D., Sriperumpudur,	A. D., Vegetable Scheme, Madras.
,,	Raghunatha Reddy, N.	A. D., Anantapur,	F. M., S. R. S., Gudiyattam.
,,	Raghavan, N.	F. M., A. R. S., Nanjanad,	F. M., Botanical, Gardents, Ooty.
,,	Raghavan, P. N.	Assistant in Entomology, Coimbatore,	A. D., Ariyalur.
,,	Ramabadran, G.	Assistant in Millets, A. R. S., Koilpatty,	Assistant in Millets, Tirupattur.
,,	Ratnakara Bhatkal,	Assistant A. R. S., Nileshwar,	A. D., Coondapur.
,,	Ramaratnam, W. S.	A. D., Wandiwashi,	F. M., Sugarcane Liaision Farm, Pugalur.
,,	Ramanadhan, G.	Assistant, in Chemistry,	A. D., Udumalpet.
,,	Ramachandran, S.	On leave,	P. A., to D. A. O., Vellore.
,,	Ramamohan Rao, K.	Assistant in Entomology, S. R. S., Anakapalle,	Assistant in Mycology, Chicacole.
,,	Rama Rao, G.	A. D., Bobbili,	Special A. D,, Bobbili.
,,	Rama Rao, D.	F. M., Arakuvally,	Special A. D., Yellamancheli.
,,	Ramanjaneyalu, S.	A. D., Koilguntla,	P. P., Assistant, Ellore.
,,	Rama Rao, G. V.	A. D., Nandigama,	Special A. D., Pathapuram.
,,	Rangamannar, D.	A. D., Rayadrug,	F. M., A. R. S., Siruguppa.
,,	Rama Rao, M. V.	A. D., Kurnool,	Assistant in Fruits, Kodur.
,,	Radhakrishna Menon,	F, M., A. R. S., Nileshwar,	Assistant in Oilseeds Cocoanut Nursery Scheme, Tindivanam.
,,	Ramanathan, S.	Assistant in Millets, Guntur,	Assistant in Millets, Ongole.
,,	Suryanarayanasarama, D.	A. D., Vegetable Scheme, Madras.	A. D., Rayachoti.
,,	Somalingam, R.	Special A. D., Mannargudi,	A. D., Musri.
,,	Sundararaman, M.	F. M., Botanical Gardens, Ooty,	A. D., Arni.
,,	Sivasankaran Nair, V. T.	Assistant in Mycology, Ooty,	Special A. D., Crop Cutting Exporters, Calicut.

Name of officers	From	To
Sri Seshagiri Rao, M.	A. D., Rapalle,	Assistant in Fruits, Kodur.
„ Seshagiri Rao, K. V.	A. D., Hindupur, (leave),	A. D., Anantapur.,
„ Sundararajan, J. S.	Assistant in F. R. S., Kodur,	Assistant in Banana Research Station, Maruthanakudy.
„ Sadagopan, R.	Assistant in Millets Coimbatore,	Assistant in Millets, Ariyalur.
„ Subba Raju, A.	F. M., Sugarcane Liaison Farm, Samalkota,	F. M., A. R. S., Samalkota.
„ Srinivasa Rao, N.	Special A. D., Temple and Math Lands, Coimbatore,	Teaching Assistant in Agriculture, Coimbatore.
„ Sankaranarayanan, C.	A. D., Namakkal,	Special A. D., Namakkal.
„ Subramania Ayyar, R.	A. D., Adirampatnam,	A. D., Peravurni.
„ Suryanarayanamurthi, A.	A. D., Chandragiri,	Special A. D., Chandragiri.
„ Suryanarayana, Y.	A. D., Sugarcane Farm, Samalkota,	A. D., Hospet.
„ Subramanian, D. S.	Special A. D., for the Tamilnad Grama Sevak Vidyalayam, Kallupatti,	A. D., Periyakulam.
„ Seshagiri Iyer, C. S.	A. D., Ariyalur,	Special A. D., Jayakondan.
„ Tiruvengadan, C. R.	A. D., Gudiyattam,	Special A. D., Gudiyattam.
„ Thomas, M.	Special A. D., Pappanad,	F. M., A. R. S., Nileshwar.
„ Venkatachalam, K.	Assistant A. D., Cuddalore,	Assistant F. M., Palur.
„ Vasudeva Singh, B.	A. D., Madukkur,	A. D., Wallajah.
„ Venkatarama Iyer, S.	A. D., Mannargudi,	A. D., Mayavaram.
„ Venkataramana Rao, V. G.	A. D., Mayavaram,	A. D., Mannargudi.
„ Viswanathan, R.	A. D., Udamalpet,	Special A. D., Udamalpet.
„ Venkatarama Reddy,	F. M., Sugarcane Liason Farm, Hospet,	A. D., Gudur.
„ Venkataramana Reddy, G.	A. D., Madanapalle,	Special A. D., Madanapalle.
„ Veeraswami, R.	Assistant in Millets, Coimbatore,	Assistant in Millets, Tirupattur.

The following candidates who have been selected by the Madras Public Service Commission are appointed to *officiate* as upper subordinates in the posts shown against each with effect from the forenoon of the 18th April 1949,

Names	To
Sri Abdul Basheer	A. D, Koilkuntla.
„ Anthoni Reddi, Y.	A. D. Kurnool.
„ Appayyan, M. C.	A. D. Orthanad.
„ Appa Rao, V.	A. D. Nandigama.
„ Appa Rao, S.	F. M. Sugarcane Liaison Farm, Samalkota.
„ Appa Rao, K.	A. D. Nugur, E. Godavari.
„ Alwa, K. S.	A. D. Karkal.
„ Appa Rao, G. V.	A. D. Punganur.
„ Arumugavel, M. R.	Marketing Assistant Tiruchirappalli.
„ Appa Rao, A.	Assistant in Cotton, Nandayal.

Names	To
Sri Anavaradham, L	Assistant in Millets, Coimbatore.
„ Anjaneyalv Naidu, N.	Fruit Assistant, Kodur.
„ Arunachalam, S. A. M.	Assistant in Entomology, S. R. S. Anakapalli.
„ Balasubramaniam, P.	A. D. Pulivendala.
„ Bhanumurthi, K. K.	F. M. Sugarcane Station, Anakapalli.
„ Bhaskara Rao, V.	A. D. Bobbili.
„ Bhabu Rao, G.	Asststant in Paddy, Pattambi.
„ Bakthavathsalu, C. M.	Assistant Horticultural Training, Madras.
„ Brahmanna, N.	A. D. Allagadda.
„ Chakarapani, K.	A. D. Seethammapeta.
„ Chandrasekharan, N. R.	F. M. A R S Puttukottai.
„ Chathukutty Nambiar, M.	Assistant in Paddy, Coimbatore.
„ Durgaprasad, S.	A. D. Gurzala.
„ Dhakshinamurthi, V.	F. M. Arakuvalley.
„ Duraiswami, K.	S. A. D. Cuddalore.
„ Dharmalingaswami, P.	F. M A. R. S Guntur.
„ Ernest, R S.	F. M. A. R. S. Nanjanad.
„ Edwin Mangala Doss, D. I.	A. D Sivaganga
„ Gajapathi, V.	A. D. Omalur.
„ Gopalakrishnamurthi, A.	A. D. Tekkali.
„ Gopalakrishna, A.	A. D. Padapatnam.
„ Gopalakrishnan, R.	Assistant A. R. S. Pattambi.
„ Hanumantha Rao, A.	A. D. Harur.
„ Janardhana Rao, P.	A D Jammalamadugu.
„ Jayaraman, M. V.	Assistant in Meteorology, Coimbatore.
Mr. Jaleel Ahmed, N.	Assistan itn Mycology, Ootacamund.
Sri Koyamu, K.	F. M. A. R. S. Nileshwar.
„ Karim, B. A.	A, D. Siruguppa.
„ Kulasekharan, C R.	A D. Virddachalam.
„ Koteswara Rao, T.	A. D. Pattikonda.
„ Krishna Rao, D. V.	A D. Gudirada.
„ Krishnamurthi, V.	A. D Tirukoilur.
„ Krishnamraju, K.	A, D. Tenali.
„ Krishnswami Rao, T. B.	A. D Avanasi.
„ Krishnamurthi, K.	A. D. Gannavaram.
„ Kamalanathan, S.	Assistant in Cotton, A. R. S. Palur.
„ Kamalakara Rao, C.	Assistant in Entomology, Siruguppa.
„ Koteswara Rao, D.	Assistant in Mycology, Bapatla.
„ Lakshmipathi Rao, S.	S. A. D., Punganur.
„ Lakshmi Reddi, M.	Assistant in Cotton, Hagari.
„ Madhava Rao, S.	A. D., Crop Cutting Experiments, Vellore.
„ Meenakshisundaram, D.	Assistant in Paddy, Coimbatore.
„ Madhava Rao, S.	A. D., Madanapalli.
„ Muthukrishnan, C. R.	Fruit Assistant, Aduthurai.
„ Muthuswami, S.	Fruit Assistant, Aduthurai.
„ Madan Mohan Rao, G.	Assistant in Entomology, Coimbatore.
„ Muthukrishnan, T. S.	Assistant in Entomology, Coimbatore.
„ Muthukumaran, S.	Assistant in Entomology, Bapatla.
„ Manickaraja Samuel,	A. D., Sugarcane Scheme, Vellore.
„ Muthuraj, M.	Assistant in Mycology, Coimbatore.
„ Narganam, W. R.	A. D., Kodaikanal.

Names	To
Sri Nelliat, E. V.	F. M., A. R. S., Pilicode.
" Narayanaswami, V.	A. D., Hindupur.
" Narasimha Raja, K. A.	A. D.. Narasapatam.
" Narasimha Rao, G. L.	(Dairy Manager), Bapatla.
" Narasa Reddi, I.	A. D., Atmakur.
" Narayana Reddi, M. S.	A. D., Nandyal.
" Nagabhushana Rao, Y.	A. D.. Sugarcane Scheme, Gannavaram.
" Narayana Rao, T.	A. D., Harpanahalli.
" Narasimha Rao, M.	A. D., Rajampet.
" Narasimha Rao, D. V.	Assistant in Millets, Siruguppa.
" Nageswara Sarma, D.	A. D., Rapur.
" Obulapathi Chowdary, S.	Assistant in Cotton, Narasarapet.
" Pappa Rao, P.	Form Manager, Bapatla.
" Purnachandara Rao, V.	A. D. Kanigiri.
" Parthasarathi, G.	A. D. Sungavarapukota.
" Pitchayya, B.	Farm Manager, Bapatla.
" Prahlada Rao, G.	A, D. Penukonda
" Prasada Rao, E. V.	A. D. Krishnadevipetta.
" Ponnuswami, M. K.	Assistant in Entomology. Nellikuppam.
" Rama Rao, B. V.	A. D. Yellavaram
" Ramasubbayya, K.	A D. Rayadrug
" Ratnakar Bhatkal,	A. D. Coondapur.
" Ramaraju, B. A.	F. M. Araku.
" Ramanathan, G.	A. D Udamalpet.
" Ramaswami, N.	A. D. Tiruppur.
" Ramalinga Reddi, K.	A D. Tirupattur,
" Ramachandaran. M.	Marketing Assistant. Coimbatore.
" Raghunatha Reddi, D.	A. D. Krishnagiri.
" Ramachandra Reddi, B.	F. M. Nandyal.
" Ramakrishnaraju, K.	A. D. Chicacole.
" Rajapadmanabhan. A. K.	A. D. Gingee.
" Raghavendra Rao, J.	A. Gudiyattam.
" Ramachandra Marar, P.	A. D. Kotagtri
" Ramanamurthi, G. V.	A. D. Bimlipatam.
" Rama Mohan Rao, R. M. V.	A. D. Rapalli
" Rajagopalan, V. T. R.	A, D. Villupuram.
" Rajagopalan, K.	A. D. Namakkal.
" Radhakrishnan, T. V.	Assistant in Cotton, Coimbatore.
" Ramalingeswara Rao, M.	Assistant in Oil Seeds, Tindivanam.
" Rathnam, C.	Assistant in Chemistry, Coimbatore.
" Raghavan, P. N.	A. D. Aryalur.
" Syed Sheriff, P.	A. D. Madukulatur.
" Samuel Ponnayya, J. H.	A. D. Tinnevelly.
" Srinivsa Rao, P.	A. D. Vayalpad.
" Sriramulu, K.	A. D. Chandragiri.
" Satyanarayane, T.	A. D. Tobacco Scheme, Sendarampatti.
" Suryanarayana, T,	A. D. Polavaram.
" Srinivaan, V.	A. D. Didigul.
" Srinivasa Rao, V.	F. M. Hagari.
" Sivaramakrishniah, Y.	A. D. Salur.
" Sithapathi Rao, C.	F. M. A. R. S. Hagari.

Names	To
Sri Somalingam, R.	A. D, Musiri.
,, Sivasnakaran Nair, V. T.	A. D. Crop cutting experiments, Calicut.
,, Sundaram, V. P.	A. D, Cheyyar.
,, Subba Rao, P.	A. D. Chipurupalle.
,, Sambandam. C. N.	A. D. Nanguneri.
,, Satyanarayaswami G,	A. D. Badrachalam.
,, Suryanarayana, S.	F. M. A. R. S. Koilpatti.
,, Sankaranarayanan, C.	A. D. Sugarcane Scheme, Namakkal.
,, Satyanarayana, S. B.	A. D. Ichapur.
,, Suryanaranamurthi, V. V.	Assistant in Paddy A. R. S. Maruteru.
,, Sethuraman, S	Assistant in Millets, Coimbatore.
,, Sambasiva Rao, I. K.	Fruit Assistant. Mettuppalayam.
,, Samuel, D. M.	Assistant in Chemistry, Coimbatore,
,, Sundaram, N. V.	Assistant in Mycology, Coimbatore.
,, Siddalinga Reddi, G.	Assistant in Mycology, Coimbatore.
,, Sriramachandran, K.	Assistant in Mycology, Coimbatore.
,, Thomas, M.	F. M. A. R. S. Nileshwar.
,, Umamheswara Rao,	F. M. A. R. S. Samalkot.
,, Venkiah, P.	A. D. Tiruvannamalai.
,, Venkata Rao, M. (B.)	F. M. Central Form, Coimbatore.
,, Venkatapathi Rao, C.	A. D. Hadagalle.
,, Venkatarama Rao, G.	A. D. Sugarcane Scheme, Peddapuram.
,, Vittal Hegde, Y.	F. M. A. R. S. Nileshwar,
,, Viswanathan, A. R.	A. D. Gobichettipalayam.
,, Vaidyanatham, R.	A. D. Tenkasi.
,, Venkata Rao, M. (B. H.)	F. M. Araku.
,, Venkataraman, R.	Assistant. in Paddy, Aduthurai.
,, Venkatesan, C.	Fruit Assistant, Kodur.
,, Venugopal, S.	Assistant in Entomology, Coimbatore.

OBITUARY.

Prof. BIRBAL SAHNI, F. R. S. (1891 — 1949)

It is with great regret, we record the death of Prof. Birbal Sahni on 9—4—1949 at his residence in Lucknow.

In the passing away of Prof. Sahni India loses one of her foremost scientists, a great teacher, and a large-hearted humanitarian. It is tragic to contemplate that just a week prior to his death, the foundation stone of the Institute of Paleobotany to which the late professor intended to dedicate himself to the rest of his life, was laid.

MEMOIR.

Prof. Birbal Sahni was born at Bhera in the Punjab on 14th November in the year 1891. His father Prof. Buch Ram Sahni was a distinguished professor of Chemistry in the Punjab Uuiversity. The late Prof. B. Sahni had his early education in Lahore, and joined the Cambridge University in 1911 where he won many academic distinctions. He was a foundation scholar and later a life member of the Emmanuel College. He received the Sc. D. degree of Cambridge and the D. Sc. degree of London While in England he had the distinction of studying under the renowned scientist Sir A. C. Seward.

In 1919, he became Professor of Botany at the Benares Hindu University. A year later he joined the Punjab University. In 1921, he was appointed as Professor of Botany at the Lucknow University, and subsequently became the Dean of the Faculty of Science in that University. He was awarded the Barday medal of the Asiatic Society of Bengal for research in Biological Science in 1931. In 1936 he was elected as a Fellow of the Royal Society.

Professor B. Sahni was intimately associated with all the progressive Scientific Association in this Country and abroad, and was one of the founder members of the Indian Botanical Society which owes much to him. He was Vice-President of the Paleo-Botany Section at the 5th International Botanical Congress held in Amsterdam in 1935 and he represented India at the third centenary celebrations of the National History Museum in Paris in 1935. He was twice (1921, 1928) President of Botany section of the Indian Science Congress and once of the Geology section of that body (1926). He was the General President of the Congress in 1940, the subject of his address on the occasion being the Deccan Traps an episode of the Territory.

Prof. B Sahni won world distinction in two fields of Science, Botany and Geology. He dedicated his life to the Course of Science, and it was characteristic of him, that at the time of his death, his one thought was the future of the Institute of Paleobotany for which he had endowed all his fortune. It is a great pity that he died before the cherished object of his life could be fulfilled

A very great man has passed away, and it is difficult to fill the gap.

The Madras Agricultural Journal

Vol. XXXVI MAY 1949 No. 5

CONTENTS.

TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high—and the Editorial Board will feel obliged if your articles are brief.

The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI May 1949 No. 5

Editorial

Organic manure: In the January Issue of 'Indian Farming' the Chief Bio-chemist Ministry of Agriculture, New Delhi, has dwelt at length on the need for building up an effective organisation for the conservation and proper utilisation of the organic matter available in our villages. According to him the chief defects in manure preparation in our villages at present are, "(a) The failure to conserve as much of cattle urine as possible in manure preparation; (b) insufficient methods of storage of manure adopted at present; (c) the failure to collect available refuse from the farm and village surroundings and to utilise the same in the cattle shed for absorption of urine; (d) the present habit of burning cowdung for fuel and (e) absence of any arrangements for conservation of human excreta and urine in villages". There is no doubt that if the above defects are remedied the possibilities of increasing our national resources of organic manures are enormous. But the problem has been how to achieve practical results in our present state of village economy. In our Province, the Agricultural Department has been making sincere and strenuous efforts during the past three decades, to effect improvements in the conservation of manure in our villages and a perusal of the earlier administration reports of the department would show that one of the main activities of the propaganda wing has been the attempt to make the villagers realise the importance of conserving organic matter.

Judging from the results achieved so far, it is evident that mere propaganda is not enough. There are certain practical difficulties which should be first overcome before implementing a full fledged programme of conservation of organic manure in the villages. To shut our eyes to the difficulties or brush aside obstacles as of no consequence is not the way to progress. Take the case of cowdung being burnt as fuel, for example. It is a wasteful practice and if in spite of years of propaganda the villager persists in this practice, it is not out of sheer cussedness, or the failure on his part to

realise that it is a valuable manure, but because no other cheap fuel is available in the villages. To provide him with substitute fuel, tree planting is suggested. This requires organised effort. What with depredation by cattle, long periods of drought and risk of theft of planted material, the task of raising trees in and around villages is not an easy one. We are of opinion that if this work is entrusted to the villagers themselves the scheme will be a failure. We suggest that the State forest departments should enlarge the scope of their activities and by raising large scale plantations of quick growing trees in suitable areas and by encouraging private enterprise the State should ensure an adequate supply of cheap fuel to the villages. This will result in cowdung being released for manure.

With regard to conservation of night soil in the villages, we have our own doubts if the efforts to conserve it will be entirely successful. For in most of our villages the collection of night soil is not feasible, since it is deposited indiscriminately in the fields and *topes* adjoining the villages and a change in the sanitary habits of the village people is necessary before anything could be done in this direction.

Finally much spade work has to be done before our villagers could be induced to take an active interest in their own welfare and accustom themselves to work for a common cause with a co-ordinated effort and a will to succeed in spite of obstacles. In the new set up with sustained interest on the part of the State and the people much could be done and we have no doubt that the difficulties which are not insurmountable will be overcome.

In this connection we are glad that the Government of Madras have taken up this matter seriously on hand and the appointment has been made of a Bio-chemist for the specific purpose of augmenting our organic manure supply.

We appeal to all Municipalities, Unions, Village panchayats and individual cultivators to avail themselves of the technical help offered by this branch of the Agricultural Department in order to increase the supply of organic manure the lack of which in sufficient quantities has seriously affected our food production so far.

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The Present Food Crisis and its Solution*

By

N. C. THIRUMALACHARYA, B. Sc (Ag), M. Sc.

Why this "Food Crisis" in India when India is mainly an agricultural country and more than 80% of the population are agriculturists? The causes are not far to seek. Agriculture as such is still in a backward state, in spite of all attempts to improve it and food production is far below consumption. This is especially so in the case of rice, the demand for which has become great while its production is low. The whole problem of food production has thus centred round rice as far as the Madras province is concerned.

In Madras province the production of rice is estimated at 50 lakhs of tons every year, while the consumption has been yearly 56½ lakhs of tons. This deficit was not felt during the pre-war years due to imports from Burma, Siam and Indo-China. The Second World War put a stop to these imports and to this was added the increased demand by the army. The situation was further aggravated by the appalling increase in the population of India. As the Food and Agricultural Council of the United Nations has pointed "In Asia the rice-eating population is increasing twice as fast as the rice output.

Attempts were made in all directions to meet this deficit. A vigorous grow more food campaign was started. A number of concessions were granted to bring in more area under cultivation; to increase the area under irrigation, and intensify cultivation by manuring and good seeding. An all-out drive for extensive green manuring was launched A five-year programme was drawn up under which small irrigation projects were contemplated. Imports from abroad were arranged and rice, maize, wheat and milo were obtained. Rationing was introduced and the movement of food grains were controlled. But all these attempts were only partially successful so much so that the situation has not materially improved and the province is still in great deficit in regard to rice.

It cannot be denied that a very sincere attempt was made by the Agricultural Department of this province to improve food production. But their efforts were thwarted by factors which were

*This paper was presented as part of at Symposium on the Food Crisis — at the College Day Conference in July 1946.

beyond their control. The cost of manures like groundnut cake was controlled and they were distributed at controlled rates. But production of cakes was low and demand was high. Chemical manures like ammonium sulphate and ammonium phosphate were arranged to be got from foreign countries and supplied. But the imports did not reach 1/5th of the requirements. Tractors were taken from the army and supplied one or two to each district to break up new lands for cultivation.

But these tractors were already "army-beaten" and no sooner were they put into the field than they went into repairs. There were no trained mechanics or spare parts to repair them. The Public Works Department were anxious to construct a number of new irrigation projects. But as one would expect, the process was slow due to want of technicians and funds. It is not surprising therefore that no immediate effect of the Grow More Food programme was felt as at best they can be only long-range schemes and the result will be seen only after some years.

What then is the immediate remedy? The only solution which would produce quick results is the "adjustment of cropping". By this I mean a regulation of the areas under each crop according to needs. In the Madras presidency the deficit in rice production works out to 10 lakhs of tons of paddy. These 10 lakhs of tons of paddy should be made good in one year. The area required to produce 10 lakhs of tons of paddy will be 13 lakhs of acres. Thus the paddy area should be increased by 13 lakhs of acres. This should be achieved by diversion of the lands not only under commercial crops but also under certain millets to paddy. Any deficit in millets and other crops can be made good by increasing its area in the dry lands. There are extensive areas of current fallows, out of which a portion can be cultivated for such purposes.

It may seem paradoxical to suggest a reduction in area under important commercial crops like cotton, groundnut, sugarcane and tobacco, when special committees for each of these crops are working with zeal to increase their production. The Indian Central Cotton Committee, the Tobacco Committee, the Oilseeds Committee and the Sugarcane Committee can all concentrate on the improvement of cultivation of these crops by improved seeds, manures etc. but not by extending the areas to the detriment of foodcrops like paddy or millets.

How is this policy to be enforced? In these days of freedom and democracy it is not possible to do it by mere propaganda. Enforcement by legislation is the only practical solution. It may be argued that during the War, in order to increase the area under pulses, an act was passed that cotton and groundnut should never be grown as pure crops but always as mixtures with a pulse-crop like blackgram, horsegram and redgram. But the return for 1945–46 showed a decrease in the area under each crop instead of an increase and thus the act was a failure. The main reason was that there was no organisation to enforce it.

If an Act called the "Agricultural Crop Adjustment Act" is passed and enforced with all earnestness it will produce amazing results in the shortest time possible By this act every ryot who grows a commercial or cash crop out of proportion to a paddy crop should be compelled to divert a portion of this area to paddy. The details should be worked out taking a district as the unit and trying to make each district self sufficient as far as possible such that the target aimed at is reached. I may point out here that this is not a new original suggestion. Such acts have been passed in countries like America with very good results and hence it is worth a trial in our province as well.

It should be emphasised that unless the enforcement of the Act is done with zeal and enthusiasm the whole scheme will fail. To achieve this end the check and supervision should be entrusted not to the Revenue Department, but to the Agricultural Department only. Even the working details of how much each ryot should grow each crop should be left to the Agricultural Department who are better judges of the ryots' conditions than the Revenue Department. This will of course mean additional work to the Agricultural Department and additional establishment and expenses But that cannot be helped. Food and Agriculture go together and anything concerning food can best be tackled only by the Agricultural Department.

The above programme is for immediate increase in the total production and to relieve the suffering millions from food scarcity within a year or two at the most. But side by side with this a long-term scheme should also be launched to meet the growing menace of the increase in population every year. The programme is nothing but the one already started viz., to increase the production by the increased use of water, better manures, and better seeds and by bringing in more area

under cultivation in a period of 5 years. The foodgrains Policy Committee has rightly come to the conclusion after reviewing the work from 1943–47 that "The measures which were undertaken were doubtless in the right direction but the objectives were far diversified, the efforts were inadequate and in most areas necessary vigour and drive were lacking. If definite results are to be achieved a radical revision of approach is necessary and a new production policy and machinery has to be devised".

In short, diversion of commercial and other nonimportant food crops to paddy in the irrigated areas and enforcing the same by legislation and introducing a Crop Adjustment Act as the immediate short term policy; and increasing the production gradually by the distribution of good seeds and large quantity of manures, by green manuring and by bringing in more of waste lands under cultivation by mechanised cultivation as a long range policy is the only solution to solve the present food crisis.

ERRATA

The Madras Agricultural Journal.

Vol. XXXVI.	No. 3.	Page 147, 8th line—read 40 feet instead of 40'.
,,	,,	Page 147, 9th line—read square instead of squiré.
,,	No. 4.	Page 188, line 33, read 100 H. P. instead of a 10 H. P.
	,,	Page 190, in the heading of the appendix third column read "ploughing by a 40 H. P. tractor instead of ploughing by a H. P. tractor".
	,,	Page 191, column three, read "ploughing by a 40 H. P." instead of "ploughing by a H. P. tractor.
	,,	Page 162 para 2 line 14 read "offset" instead of "affect".

Cardamom Thrips—and Its Control

By
M. S. SUBBIAH, B.A., B.Sc., (Ag.)
Assistant Entomologist.

Cardamom—*Elettaria cardamom*—is a spice crop, the produce of which is of late commanding very attractive prices in the market. The cultivation of this crop is, therefore being extended wherever possible. One of the main factors that has discouraged the large-scale extension of this crop is its susceptibility to a few insect pests of which the cardamom thrips—*Taeniothrips cardamomi* is the most important. The damage caused by these insects is so severe that the entire crop is ruined during certain years. The author has known a few cases where some of the plantations were abandoned, as the cultivation was not worth the trouble, in such badly infested localities; nor were the planters uniformly enthusiastic about starting new areas due to their utter helplessness against these tiny insects. As the situation was very alarming a scheme of research for the control of this pest was instituted during October 1944 under the aegis of the Indian Council of Agricultural Research. The scheme has been running now for the past four years and some very useful information has been gathered regarding the control of these thrips. It is therefore thought that the publication of this short note on the results obtained may be helpful to the cardamom planters.

The cultivation of cardamom is at present restricted to the sub-montane regions of the Western Ghats on elevations ranging from 2,500–4,000 feet with an average annual rainfall of 100–200 inches. The crop thrives best in areas where the rainfall is evenly distributed throughout the year. Apart from the proper elevation and rainfall, this crop also requires adequate natural shade. No special arrangements are, however, made to grow these shade trees as in the case of coffee but the crop itself is planted in evergreen sholas well protected from high winds, after thinning out the superfluous trees. The crop is propagated either by bulbs themselves or by planting two to three years—old seedlings raised in carefully prepared nurseries. The planting is done during May—June just before the monsoon rains. The crop needs very little after-care, except for the filling up of gaps wherever necessary and an occasional weeding. The clumps grow and begin to flower from the third year onwards. The flower stalks spring out from the ground level and either shoot up to a height of two to peculiar feature of the variety. These bushes flower practically

throughout the year. But the peak occurs from May to August and corresponding to the flowering the main harvest extends from September to December. There may be eight pickings in a year. Normal bearing commences from the fifth year onwards and continues up to the fifteenth year, the average yield being about 120 lb. per acre

The pest—*Taeniothrips cardamomi*—is a small dark-brown insect, provided with lacerating and sucking mouth parts. The eggs are thrust singly, partly embedded in the tender tissues of the leaf-sheaths, spindles, flower bracts, etc. The nymphs hatch out in about a week and these are wingless but resemble the adults in general features and in their mode of feeding. They moult thrice in the course of 15—21 days and then pupate. The adults emerge in 10—15 days after pupation. The whole life-cycle is completed in 32—46 days.

The insects hide under the green leaf-sheaths, spindles, floral bracts, flowers and on tender fruits and feed on the plant sap. They breed in enormous numbers from May to August, which synchronises with the main flush when the oviposition and feeding is more concentrated on the racemes, which then literally teem with insect population. On account of the heavy drain of the cell sap in the infested racemes, the flowers and tender fruits wither away and drop off. The few fruits that survive the damage develop characteristic scabs or pustules on the surface due to the irritation caused by the scraping of the insects The degree of such scabbing varies with the intensity of the damage The infested pods are undersized with only a few chaffy seeds without the fine aroma and taste and as such do not fetch a good price in the market The damage therefore, consists in the appreciable reduction of the produce both in quantity and quality. As an outstanding example of the potentialities of this pest, the yield in one particular estate was reduced to 16 lb. per acre, while during normal years it was 120 lb.

Control Measures: The line of work in this direction lay in finding a cheap and efficient insecticide which has necessarily to be applied at frequent intervals to protect the flushes that come out almost throughout the year. A number of insecticides such as Paris green, sulphur, tobacco, Acorus, Tartar emetic, Lobelia, Nicotine sulphate, D. D. T., Dedetane and Gammexane were tried either as dusts or sprays, the treatments being restricted to the floral parts only. During the initial trials Nicotine sulphate spray at 0·05% gave some encouraging results. But the recent advent of the

insecticide Benzene hexachloride (Gammexane) has practically revolutionised the method of control. This dust (Gammexane D. 025) when applied at the rate of 4 lb. per acre per application was found to have a remarkable effect against the pest. It was however necessary to repeat the treatments at monthly intervals or whenever there was an indication of either re-infestation or increase of pest population. A perusal of the statement showing the details of the insecticides tried at different intervals, would indicate that this pest can be very effectively checked and the yields increased by applying Gammexane at monthly intervals at 4 lb. per acre costing only Rs. 2—15—0 per dusting. The calculated net profit per acre from the plots treated with Gammexane is computed to be Rs. 243/0. In actual practice, however, the dustings need not be taken up during the rainy months and it is therefore suggested that eight applications judiciously regulated according to the incidence of the pest would effectively solve the problem of thrip damage in the cardamoms.

Statement Showing the Economics of the Differrcnt Treatments.

No.	Treatments	Interval	Yield per acre in dry weight	Percentage of scab free pods	Increase over controls	Cross value of Produce		Cost of treatment		Net value		Increas overe control	
1	2	3	4	5	6	7		8		9		10	
						Rs.	A.	Rs.	A.	Rs.	A.	Rs.	A
1	Garmmexane @ 4 lbs. per acre.	Monthly	123.3 lb.	67	92.6 lb.	411	13	33	12	378	1	310	7
2	Do.	Once in two months	52.8 lb.	42	22.1 lb.	154	2	16	14	137	4	69	10
3	Nicotine sulphate 0 5%; 20 gallons per acre.	Monthly	110.8 lb.	49	80..1 lb.	340	1	81	0	259	1	191	7
4	Do.	Once in two months	82.6 lb.	29	51.9 lb.	218	6	40	8	178	14	111	4
5	Controls—no treatment,	...	30.7 lb.	12	...	67	10	...		67	10	...	

Agriculture in our New India

By

SRI. P. G. KARUTHIRUMAN, B. Sc.*

An address delivered at the Hope Polytechnic to the students of automobile engineering.

I should first of all thank my friend Mr. G. D. Naidu for giving me this opportunity of addressing you, the students of automobile engineering and allied sciences, on the importance of agriculture and my experiences as a practical agriculturist.

Our country as you all know, is a very large one. Nearly 87% of our population live in villages and are mainly dependent upon agriculture for their livelihood. In spite of this, it is sad to note that our country is not self-sufficient in regard to food and has to be importing food from foreign countries at enormous cost. To meet the food crisis it is the duty of all of us, as true sons of India, to so fashion the work of agricultural production that our country men could be fed without the help of any alien country. For achieving this end, we should concentrate upon the work of increasing the yield of food grains with sincerity of purpose and on a scientific well-planned basis. The Agricultural Department has issued a number of improved varieties, but the ryot is not always able to obtain the maximum yields that these improved varieties are capable of. If the ryot is to secure thus, it essential that sufficient care and attention are devoted to prepare the land in the proper way and maintain their fertility by adding sufficient manure to the soil. All manures can be grouped into two main classes, natural and artificial. Natural manures which are also known as organic or bulky manures, are to be found in cattle manure, composts and green manures. If we apply natural manure to the soil only apart of it becomes available to the crop in the first year, the rest is all left in the soil and is utilised by subsequent crops. By applying natural manures every year in sufficient quantities, it is possible to keep up the fertility of the land without deterioration. In applying artifical manures like ammonium sulphate, superphosphate, there is the advantage that the manures are immediately available to the plants, so that the plants grow very vigorously. But greater care and a better judgement is necessary in using artificial manures — if the fertility of the land is to be maintained at a high level.

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*Mr. P. G. Karuthiraman is a progressive agriculturist of the Coimbatore District.

Mere application of manures will not by itself give a high yield, but it is also essential to give constant attention to the field—i. e., by way of proper preparation, tillage, drainage and irrigation at suitable intervals etc. Coming to my experiences as an agriculturist, I propose to deal on this occasion with only paddy cultivation. For success in paddy cultivation, the use of good seed is a vital factor. Paddy that is intended to be used as seed should be harvested when the grain is fully ripe, dried carefully and preserved free from attack of insect pests or fungus diseases. The seeds should be taken out and dried in the sun at least once in every two months. Before sowing the seed in the nurseries it should be treated with Agrosan or Ceresan, so that any fungus spores that may be present may be destroyed. Paddy seed should be steeped in water for twenty-four hours and then sown in the nursery. The nursery bed should be well prepared and carefully levelled, so as to allow quick drainage. In the beginning, for four days, water should be let into the nursery in the evening and drained off the next morning. On the fifth day the nursery is kept without water for 24 hours. Then every alternate day water is allowed. From the fifteenth day onwards a continuous flow of water is maintained. Then comes the transplanting of these seedlings. The fields are previously prepared, giving two ploughings after manuring, and then water is let in and the fields well puddled and levelled. It will be very beneficial if concentrated manures are applied to the fields just before transplanting the seedlings. At this juncture no water should be allowed to drain out of the fields. The age of the seedlings for a crop of six months duration should not be more than 45 days at planting time. The seedlings are planted six inches apart and not more than three seedlings should be planted in one clump. After transplantation no water should be allowed for 24 hours, what little water there is in the field should all be absorbed by the soil. Another important point is that the puddled field should never be allowed to dry or form cracks. Waterings after transplanting should be done very carefully, so that the manures applied are not washed away by the water. During the growing period the fields should be kept free of weeds—by growing two or three weedings. Flowering commences usually from about the twelfth week after transplantation; the crop requires at this time large quantities of water, but care should be taken that water does not stagnate in the fields. The bunds should be so adjusted that there will be an uniform flow of water, without allowing the fields to get dry.

A paddy crop is liable to get damaged by a number of diseases and also by a various insect pests, such as stem borer and the rice bug. Stem borers can be controlled by means of light traps and by pulling out and burning all affected plants. The rice bug can be controlled by keeping the bunds free of grass and other weeds — to prevent eggs being laid on them and by bagging the bugs and killing them.

Only by constant care and attention to the crop at all stages can we raise a good crop of paddy. We should have patience and also industry — if our lands are to be improved and kept in a condition that will give us good yields per acre year after year.

Our Government, in their Grow More Food Campaign concentrate their attention on the procurement side alone, and do not give sufficient attention to the real and vital problem of helping the agriculturists in raising good crops in their fields. If the Government is prepared to supply two hundredweights of bonemeal and two cwts. of fish meal per every acre of paddy land and the people of the Agricultural Department approach the peasants and render all possible assistance, I am sure the food crisis can be easily tided over. We, as true sons of our motherland should serve our country by increasing food production by our concerted efforts and by growing crops on a scientific basis. By so doing we can get good food and more food. We need not import any food grain from foreign countries. We should be in a position to export our surplus grain to other countries. Then and then alone can we claim to be true and worthy sons of our motherland and make our country second to none in food production.

A Soil Survey for Fruit Development in the Ceded Districts (Contd.)*

By

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APPENDIX I.

Statement showing the profile characteristics, stones, water-soluble salts and natural reserves of Calcium Carbonate in the soil samples.

Number of Sample	Area	Village	Pit No.	Depth	Colour	Texture	Stones	Natural reserves of Calcium Carbonate Effervescence with Dil. Acid	Water soluble salts	Remarks
1	2	3	4	5	6	7	8	9	10	11
1	Kottur	Kottur	1	0'—1'	Red	Sandy loam	12·0	Nil	·015	Shallow soil—Dis-
2				1'—2'	,,	Gravelly	53·0	,,	·023	integrated granite at
3				2'—3'	Brown	,,	56·0	Very slight	·035	3 ft. depth
4		Chapparadhalli	2	0'—1'	Brown	Loamy	2·2	Nil	·017	Soil of moderate depth
5				1'—2'	,,	,,	0·3	Moderate	·037	rock at 5 feet
6				2'—3'	,,	,,		Slight	·041	
7				3'—4'	,,	,,		,,	·046	
8				4'—5'	Light Brown	Gravelly		Brisk	·49	
9		Kodihalli	3	0'—1'	Red	Gravelly	63·1	Nil	·034	Deep Soil Granite
10				1'—2'	,,	Loamy	2·6	,,	·017	at 7 ft
11				2'—3'	,,	,,	2·5	,,	·020	
12				3'—4'	Brown	,,	9·8	,,	·024	
13				4'—5'	Light Brown	,,	7·1	Slight	·079	
14				5'—6'	,,	,,	10·2	Moderate	·052	
15				6'—7'	,,	,,	15·1	Slight	·052	

*Continued from Vol. XXXVI, No. 3, P. 123.

Number of Sample	Area	Village	Pit No.	Depth	Colour	Texture	Stones	Natural reserves of Calcium Carbonate Effervescence with Dil. Acid.	Water soluble salts	Remarks
1	2	3	4	5	6	7	8	9	10	11
16		Maruru	4	0'—1'	Red	Loamy	10·8	Slight	·044	Deep soil, Parent
17				1'—2'	,,	,,	0·7	Nil	·016	rock (granite) at 7 ft.
18				2'—3'	,,	,,	1·3	,,	·022	
19				3'—4'	,,	,,	4·6	,,	·021	
20				4'—5'	,,	,,	12·6	Very slight	·033	
21				5'—6'	Brown	,,	15·0	Slight	·046	
22				6'—7'	,,	Gravelly	53·9	,,	·035	
23		Himoselette	5	0"— 9"	Red	Loamy	8·8	Nil	·050	Shallow soil. Rock at
24				9"—18"	,,	,,	3·3	,,	·011	2½ ft.
25				18"—30"	Brown	Gravelly	58·0	,,	·023	
26				30"—34"	Very little soil			Disintegrated rock		Pegmatite
27				Below 34"				Rock		
28		Jagategiri	6	0"—6"	Red	Loamy	30·0	Nil	·011	Very shallow soil.
29				12"—18"	Brown	Gravelly	56·0	Nil	·018	Fine grained pegmatite
30				18"—24"			Rock	—	Pegmatite.	at 1½ ft.
31		Herevadaraja	7	0"—9"	Brown	Sandy	16·8	Very slight	·022	Fairly deep soil. Rock
32				9"—18"	,,	,,	12·4	Nil	·018	at 6 feet.
33				18"—30"	,,	,,	16·5	,,	·010	
34				30"—40"	,,	,,	19·2	,,	·013	
35				40"—48"	,,	,,	12·7	Very slight	·013	
36				4'—5'	,,	,,	8·2	Nil	·011	
37				5'—6'	,,	Clayey	12·3	Very slight	·068	
38		Chinnenahalli	8	0'—1'	Red	Loamy	24·4	Nil	·012	Very shallow soil Rock
39				1'—2'	,,	,,	46·0	,,	·095	at 2 ft.

40		Harkanahalu	9	0'—'1	Red	Loamy	3·1	Nil	·027	Shallow soil Rock
41				1'—'2	,,	,,	19·9	,,	·055	at 3 ft.
42				2'—'3	,,	Gravelly	64·0	,,	·067	
43		Konanahalli	10	0'—1'	Red	Loamy	5·6	Nil	·032	Shallow soil. Rock
44				1'—2'	,,	,,	4·7	,,	·021	at 3½ ft.
45				2'—3½'	,,	,,	27·7	,,	·045	
46		Nadamanahalli	11	0'—1'	Brown	Loamy	4·0	Nil	·019	Soil of moderate depth.
47				1'—2'	Black	Clay loam	1·5	Slight	·131	Kankar at 5½ ft.
48				2'—3'	,,	,,	1·9	Moderate	·205	
49				3'—5½'	,,	,,	13·0	Brisk	·265	
50		Kalapuram	12	0'—1½'	Red	Loamy	0·5	Nil	·017	Moderately deep soil.
51				1½'-3'	Brown	,,	0·2	,,	·017	Rock at 5 ft.
52				3'—4'	,,	,,	1·0	,,	·017	
53				4'—5'	,,	,,	39·7	,,	·022	
54		,,	13	0'—1'	,,	,,	4·4	,,	·015	Shallow soil. Rock
55				1'—2'	,,	,,	13·5	,,	·015	at 3 ft.
56				2'—3'	,,	,,	15·0	,,	·030	
57		Ujjini	14	0'—1'	,,	Clay Loam	7·8	Slight	·030	Very shallow soil.
58		,,		1'—2'	Black	,,	15·5	Moderate	·070	Rock at 2 ft.
59	Kottur	Ujjini	15	0'—1½'	Grey	Clay loam	13·9	Slight	·036	Shallow soil. Rock
60		,,		1½'-3'	,,	,,	4·2	Moderate	·078	at 3 ft.
61		,,			,,	,,		Rock		Amphibolite
62	Rudravaram	Kondamayapalli	16	0'—1'	Light Brown	Loamy	0·4	Nil	·021	Water table at 5 ft.
63				1'—2'	Yellow	Clay loam	0·1	Nil	·045	
64				2'—3'	,,	,,	2·1	,,	·038	
65				3'—4'	,,	,,	11·0	,,	·026	
66				4'—5'	,,	,,	16·2	,,	·029	
67		Valagalapalli	17	0'—1'	Brown	Loamy	7·7	,,	·034	Water table at 5 ft.
68				1'—2'	,,	,,	7·2	,,	·040	
69				2'—3'	,,	,,	7·8	,,	·074	
70				3'—4'	,,	,,	8·9	Moderate	·054	
71				4'—5'	,,	,,	15·4	Slight	·056	

Number of Sample	Area	Village	Pit No.	Depth	Colour	Texture	Stones	Natural reserves of Calcium Carbonate (Effervescence with Dil. Acid)	Water soluble salts	Remarks
1	2	3	4	5	6	7	8	9	10	11
72		Negireddipalli	18	0'—1'	Brown	Clay	15·6	Nil	·049	Water table at 5 ft.
73				1'—2'	„	Clayey	10·6	Slight	·064	Plenty of ferruginous
74				2'—3'	„	„	16·0	Very slight	·041	gravel in the deeper
75				3'—4'	„	Gravelly	75·6	Slight	·060	layers.
76				4'—5'	„	„	83·1	„	·047	
77		Rudravaram	19	0'—1'	Light Brown	Loamy	1·7	Nil	·018	Water table at 5 ft.
78				1'—2'	Brown	„	0·1	„	·016	Chini garden
79				2'—3'	„	„	1·3	„	·252	
80				3'—4'	„	„	0·3	„	·022	
81				4'—5'	Yellow	„	3·3	„	·022	
82		Rudravaram	20	0'—1'	Red	Sandy	1·6	„	·028	Water table at 4 ft.
83				1'—2'	„	„	1·4	„	·041	Sandy soil—Mango
84				2'—3'	Reddish Yellow	„	3·5	Slight	·092	garden.
85				3'—4'	„	Sandy loam	17·3	„	·079	
86		Rudravaram	21	0'—1'	Brown	„	10·2	Nil	·066	Water table at 5 ft.
87				1'—2'	Yellow	„	4·5	„	·030	Mango garden.
88				2'—3'	„	Clay loam	8·0	„	·048	
89				3'—4'	„	„	6·3	„	·058	
90				4'—5'	„	„	13·0	„	·056	
91		Gonampalli	22	0'—1'	Brown	Sandy	12·6	„	·017	Water table at 5 ft.
92				1'—2'	„	Loamy	37·6	„	·023	Plenty of ferruginous
93				2'—3'	„	„	39·6	Brisk	·044	gravel in the deeper
94				3'—4'	Light Brown	Clay loam	17·8	„	·051	layers.
95				4'—5'	Yellow	„	22·1	„	·047	
96	Rudravaram	Gonampalli	23	0'—1'	Red	Loamy	31·6	Nil	·039	Water table at 5 ft.
97				1'—2'	„	„	33·7	„	·075	Plenty of ferruginous

98	Rudravaram	Gonampalli	23	2'—3'	Brown	,,	38·9	Slight	·089	gravel in the deeper
99				3'—4'	Brown	Gravelly	77·3	Nil	·167	layers.
100				4'—5'	Light Brown	,,	80·5	,,	·195	
101		Chinnakam-baluru	24	0'—1'	Yellow	Loamy	10 1	Nil	·090	Rocks of the Cuddapah formations met with
102				1'—2'	,,	Clay Loam	29·1	Slight	·057	at 5 ft.
103				2'—3'	,,	,,	24·0	Nil	·071	
104				3'—4'	,,	,,	9·0	Nil	·166	
105				4'—5'	,,	,,	34·9	Slight	·226	
106		Peruru	25	0'—1'	Red	Sandy	1·1	Very Slight	·031	Water table at 5 ft.
107				1'—2'	,,	,,	8 0	Nil	·058	Sandy soil.
108				2'—3'	,,	,,	3·6	Nil	·039	
109				3'—4'	,,	,,	2·3	Slight	·051	
110				4'—5'	,,	,,	3·2	,,	·033	
111		Erraguntla	26	0'—1'	Grey	Loamy	47·6	Brisk	·089	Water table at 4 ft
112				1'—2'	,,	,,	53·2	,,	·077	plenty of ferruginous
113				2'—3'	Yellow	,,	52·2	,,	·062	gravel.
114				3'—4'	,,	Gravelly	62·1	,,	·059	
115		Near Wakkileru	27	0'—1'	Brown	Loamy	29·6	Moderate	·191	Deep soil. Neither
116				1'—2'	,,	,,	34·5	,,	·135	water table nor rock
117				2'—3'	Light Brown	,,	26·7	,,	·190	up to ft. 8 Kankar
118				3'—4'	,,	,,	26·5	,,	·211	nodules from 5 ft.
119				4'—5'	Yellow	,,	26·5	Slight	·215	downwards.
120				5'—6'	,,	,,	26 4	,,	·203	
121				6'—7'	,,	,,	40·9	Brisk	·093	
122				7'—8'	,,	,,	37·4	Moderate	·193	
123	Rudravaram	Gonampalli	28	0'—1'	Yellow	,,	28 5	Very slight	·041	Deep soil. Neither
124				1'—2'	,,	,,	20·8	,,	·051	water table nor rock
125				2'—3'	,,	,,	24·1	,,	·069	met with. Kankar no-
126				3'—4'	,,	,,	38 2	Slight	·090	dules from 5 ft. down-
127				4'—5'	,,	,,	38·3	Moderate	·108	wards.
128				5'—6'	,,	Gravelly	65·3	,,	·100	
129				6'—7'	Brown	,,	50·4	,,	·100	
130				7'—8'	,,	,,	58·6	,,	·089	

Number of Sample	Area	Village	Pit No.	Depth	Colour	Texture	Stones	Natural reserves of Calcium Carbonate Effervescence with Dil. Acid	Water soluble salts	Remarks
1	2	3	4	5	6	7	8	9	10	11
131		Near Bandaru-vagu	29	0'—1'	Brown	Loamy	9·1	Nil	·029	Deep soil. Neither rock nor water up to 8 ft. depth. Kankar nodules from 4 ft. downwards. Plenty of ferruginous gravel.
132				1'—2'	,,	,,	10·4	,,	·034	
133				2'—3'	,,	Sandy loam	40·3	Slight	·037	
134				3'—4'	,,	,,	52·8	Moderate	·044	
135				4'—5'	,,	,,	57·5	,,	·047	
136				5'—6'	,,	,,	49·3	,,	·051	
137				6'—7'	,,	,,	29·8	Slight	·045	
138				7'—8'	,,	,,	35·5	,,	·052	
139		Sirvel	30	0'—1'	Grey	Loamy	43·3	Moderate	·032	Water table at 3 ft. Plenty of ferruginous gravel. Rocks of the Cuddappah formation at 3 ft. (Chini garden)
140				1'—2	,,	Gravelly	68·7	Nil	·029	
141				2'—3'	,,	,,	78·0	,,	·040	
142		,,	31	0'—1'	,,	Loamy	38·2	,,	·025	Rock and Water table at 4 ft. plenty of ferruginous gravel in the 4th ft.
143				1'—2'	,,	,,	27·1	,,	·032	
144				2'—3'	,,	,,	26·5	Slight	·038	
145				3'—4'	,,	Gravelly	69·0	Very slight	·041	
146		,,	32	0'—1'	Grey	Clay loam	22·6	Brisk	·042	Water table at 4 ft. Plenty of ferruginous gravel.
147				1'—2'	Yellow	Loamy	46·9	,,	·046	
148				2'—3'	,,	Gravelly	60·3	,,	·054	
149				3'—4'	,,	,,	68·6	,,	·055	
150	Sirvel	Sirvel	33	0—1'	Grey	Loamy	27·8	Subject	·045	Water table at 5 ft. Plenty of ferruginous gravel Cheeni garden.
151	,,	,,		1—2'	,,	,,	28·3	,,	·062	
152	,,	,,		2—3'	,,	,,	38·0	,,	·066	
153	,,	,,		3—4'	,,	Gravelly	68·2	,,	·046	
154	,,	,,		4—5'	,,	Sandy loam	19·2	,,	·049	

155	Giddalore	Giddalore	34	0'—1'	Grey	Loamy	27·0	,,	·039	Rocks of the Cuddappah formations at 6 ft. Plenty of ferruginous gravel especially in deeper layers.
156				1'—2'	,,	,,	26·0	,,	·061	
157				2'—3'	,,	,,	33·7	,,	·048	
158				3'—4'	,,	,,	34·1	,,	·046	
159				4'—5'	,,	,,	49·8	,,	·043	
160				5'—6'	,,	,,	53·0	,,	·045	
161		,,	35	0'—1'	Brown	Loamy	4·6	Nil	·042	Rock at 6 ft. Kankar nodules in the deeper layers.
162				1'—2'	,,	,,	5·0	Brisk	·055	
163				2'—3'	,,	,,	10·9	,,	·055	
164				3'—4'	,,	,,	21·9	,,	·052	
165				4'—5'	,,	,,	34·9	,,	·048	
166	Giddalore	Giddalore		5'—6'	Brown	Loamy	40·6	Brisk	·050	
167		Settireddipalli	36	0'—1'	Red	,,	42·5	Brisk	·025	Rock at 6 ft. Water table in the well nearby about 35 ft.
168				1'—2'	,,	,,	21·0	,,	·030	
169				2'—3'	,,	,,	25·2	,,	·030	
170				3'—4'	,,	,,	17·2	,,	·032	
171				4'—5'	Brown	,,	36·1	,,	·035	
172				5'—6'	,,	,,	22·5	,,	·036	
173		Ambavaram	37	0'—1'	,,	Sandy	2·7	Nil	·020	Rock at 7 ft.
174				1'—2'	,,	Loamy	17·1	Moderate	·035	
175				2'—3'	Light Brown	,,	15·1	,,	·040	
176				3'—4'	,,	,,	11·8	,,	·039	
177				4'—5'	,,	,,	27·5	,,	·036	
178				5'—6'	,,	,,	30·3	,,	·039	
179				6'—7'	,,	,,	48·4	,,	·032	
180		Uppalapadu	38	0'—1'	,,	,,	11·5	,,	·029	Rock at 5 ft.
181				1'—2'	,,	,,	19·2	Brisk	·041	
182				2'—3'	,,	,,	24·7	,,	·056	
183				3'—4'	,,	,,	32·6	,,	·068	
184				4'—5'	,,	,,	47·0	,,	·078	
185		Rajupeta	39	0'—1'	Red	Loamy	33·8	Moderate	·031	Deep soil. Neither rock nor water table met with.
186				1'—2'	,,	,,	30·5	Brisk	·034	
187				2'—3'	,,	,,	7·8	,,	·039	
188				3'—4'	,,	,,	9·9	Moderate	·034	

Number of Sample	Area	Village	Pit No.	Depth	Colour	Texture	Stones	Natural reserves of Calcium Carbonate Effervescence with Dil. Acid	Water soluble salts	Remarks
1	2	3	4	5	6	7	8	9	10	11
189		Rajupeta	39	4'—5'	Light Brown	,,	33·2	,,	·037	
190				5'—6'	,,	,,	38·2	,,	067	
191				6'—7'	,,	,,	25 5	,,	·078	
192				7'—8'	,,	,,	25·8	,,	·079	
193		Kanchipalli	40	0'—1'	Red	Loamy	54·3	Moderate	·206	Rock at 6 ft. Water table in well nearby 30 ft.
194				1'—2'	,,	,,	31·2	Slight	·090	
195				2'—3'	,,	,,	25·4	,,	·136	
196				3'—4'	,,	,,	22·4	Moderate	·139	
197				4'—5'	,,	,,	19 4	Brisk	·051	
198				5'—6'	,,	,,	8·4	Moderate	·033	
199		Krishnamsetti-palli.	41	0'—1'	Light Red	Sandy loam	1·3	Brisk	·036	Deep soil. Rock at 8 ft.
200				1'—2'	,, ,,	,,	12·4	,,	·042	Water table in nearby well 30 ft.
201				2'—3'	Brown	Loamy	10·5	,,	·040	
202				3'—4'	,,	,,	14·9	,,	·042	
203				4'—5'	,,	,,	7·1	Nil	·069	
204				5'—6'	,,	,,	7·6	,,	·086	
205				6'—7'	,,	,,	0·6	,,	·020	
206				7'—8'	,,	Clay Loam	0·4	,,	·021	
207		,,	42	0'—1'	Red	Loamy	1·8	,,	·022	Rocks of the Cuddappah formations at 5 ft.
208				1'—2'	,,	,,	2·1	Very alight	·043	
209				2'—3'	,,	,,	7·6	Moderate	·051	
210				3'—4'	,,	,,	0·2	Nil	·025	
211				4'—5'	Brown	,,	1·6	Brisk	·033	
212		Diguvametta	43	0'—1'	Red	Loamy	3·2	,,	·034	Rock at 5 ft.
213				1'—2'	,,	,,	4·2	Moderate	·034	
214				2'—3'	Brown	,,	14·2	,,	·036	

215				3'—4'	,,	,,	28·0	Brisk	·032	
216		Diguvametta	43	4'—5'	,,	,,	34·1	,,	·036	
217		,,	44	0'—1'	Red	Sandy loam	30·1	,,	·037	Rock at 4 ft.
218				1'—2'	,,	,,	33·2	,,	·036	
219				2'—3'	Brown	,,	8·2	Nil	·033	
220				3'—4'	,,	,,	5·0	,,	·025	
221		,,	45	0'—1'	Red	Loamy	20·6	,,	·027	Rock at 4 ft.
222				1'—2'	,,	,,	11·7	,,	·031	
223				2'—3'	Brown	,,	27·1	Brisk	·036	
224				3'—4'	,,	,,	8·2	,,	·047	
225		,,	46	0'—1'	,,	Gravelly	61·6	,,	·042	Rock at 3 ft. Kankar nodules from 2nd ft.
226				1'—2'	Grey	Clay loam	10·5	Moderate	·034	
227				2'—3'	,,	Loamy	40·0	Brisk	·039	
228		,,	47	0'—1'	Red	Sandy loam	32·0	,,	·038	Rock at 3 ft. Water-table in nearby well 35 ft.
229				1'—2'	Brown	Loamy	44·8	,,	·238	
230				2'—3'	,,	,,	4·0	,,	·100	
231	Vontimitta	Chenchugari-palli.	48	0'—1'	Red	Loamy	31·3	Very slight	·040	Rock at 6 ft Water table 10 ft. Plenty of stones especially in deeper layers.
232				1'—2'	,,	,,	29·0	Slight	·056	
233				2'—3	,,	Gravelly	67·0	,,	·053	
234				3'—4'	Brown	,,	79·0	,,	·057	
235				4'—5'	,,	,,	83·5	,,	·049	
236				5'—6'	,,	Loamy	43·7	Brisk	·039	
237		Kottapalli	49	0'—1.	Grey	Loamy	15·3	,,	·056	Water table at 5 ft.
238				1'—2'	,,	,,	18·6	Very slight	·037	
239				2'—3'	,,	,,	19·7	,,	·038	
240				3'—4'	,,	,,	37·2	Slight	·040	
241				4'—5'	,,	Gravelly	85·5	Brisk	·064	
242		Vontimitta	50	0'—1'	Red	Loamy	51·5	,,	035	Rock at 4 ft. Water table very low - 35 ft Plenty of stones.
243				1'—2'	,,	Gravelly	74·3	Slight	·049	
244				2'—3'	Brown	,,	62·8	Brisk	·039	
245				3'—4'	,,	Loamy	48·2	,,	·042	

Number of Sample	Area	Village	Pit No.	Depth	Colour	Texture	Stones	Natural reserves of Calcium Carbonate Effervescence with Dil. Acid	Water soluble salts	Remarks
1	2	3	4	5	6	7	8	9	10	11
246		Ratsapalli	51	0'—1'	,,	Gravelly	77·6	Nil	·036	Rock at 6 ft. Plenty of stones. Water table at 15 feet.
247				1'—2'	,,	,,	74·2	,,	·024	
248				2'—3'	Grey	,,	74·0	Brisk	·041	
249				3'—4'	Light Brown	,,	65·2	,,	·040	
250				4'—5'	,,	,,	70·4	,,	·036	
251				5'—6'	,,	,,	73·6	,,	·037	
252		Chalabad	52	0'—1'	Brown	Loamy	22·5	Very slight	·069	Rock at 6 ft. Water table at 10 ft.
253				1'—2'	,,	,,	21·5	,,	·105	
254				2'—3'	,,	Sandy loam	13·2	Slight	·090	
255				3'—4'	,,	,,	14·2	Very slight	·064	
256				4'—5'	,,	,,	7·3	Slight	·047	
257				5'—6'	,,	,,	30·5	Moderate	·036	
258		Polubuchayya-garipalli.	53	0'—1'	Light brown	Loamy	41·5	Brisk	·051	Sandstone at 4 ft. Plenty of stones.
259				1'—2'	Grey	Gravelly	73·7	Moderate	·041	
260				2'—3'	,,	,,	81·8	,,	·041	
261				3'—4'	,,	,,	84·0	Very slight	·039	
262		Nadimpalli	54	0'—1'	Brown	Sandy loam	57·2	slight	·037	Rock at 4 ft. Plenty of stones.
263				1'—2'	,,	Gravelly	65·7	,,	·051	
264				2'—3'	,,	,,	63·7	Moderate	·049	
265				3'—4'	,,	,,	77·9	Brisk	·090	
266		Cherlopalli	55	0'—1'	Light Brown	Sandy loam	55·6	Nil	·024	Water table at 4 ft. Plenty of stones.
267				1'—2'	,,	Gravelly	70·4	,,	·025	
268				2'—3'	Brown	,,	82·5	,,	·029	
269				3'—4'	,,	,,	67·3	Brisk	·045	

270	Mangampet	56	0'—1'	Light Brown	Loamy	43·6	,,	·039	Rock at 5 ft. Plenty of stones.
271			1'—2'	Red	,,	39·8	,,	·043	
272			2'—3'	,,	,,	44·7	,,	·041	
273			3'—4'	Brown	Gravelly	60·3	,,	·043	
274			4'—5'	,,	,,	74·6	,,	·047	
275	Mantapampalli	57	0'—1'	Brown	Sandy loam	14·2	Moderate	·039	Sri Chellama Reddy's land Natural soil. Rock at 5 ft. Water table at 10 ft.
276			1'—2'	,,	,,	14·2	Nil	·024	
277			2'—3'	Grey	,,	31·7	,,	·035	
278			3'—4'	,,	Gravelly	65·8	,,	·043	
279			4'—5'	,,	Sandy loam	5·0	,,	·030	
280	,,	58	0'—1'	Red	Sandy loam	18·6	,,	·045	Water table at 6 ft. Sri Chellama Reddy's land. Natural soil.
281			1'—2'	,,	,,	4·2	,,	·037	
282			2'—3'	Brown	Loamy	4·7	,,	·036	
283			3'—4'	,,	,,	3·5	,,	·035	
284			4'—5'	,,	,,	4·1	,,	·030	
285			5'—6'	,,	,,	2·4	,,	·030	
286	,,	59	0'—1'	Red	Sandy loam	14·7	Brisk	·043	Rock at 4 ft. Plenty of stones in the deeper layer. Sri Chellama Reddy's made-up soils. Water table at 20 ft.
287			1'—2'	,,	,,	8·2	,,	·043	
288			2'—3'	Brown	Loamy	6·3	,,	·045	
289			3'—4'	,,	,,	35·7	,,	·055	
290	,,	60	0'—1'	Red	Sandy loam	14·7	,,	·044	Made-up soil. Rock at 4 ft. plenty of stones.
291			1'—2'	,,	,,	34·0	,,	·045	
292			2'—3'	,,	,,	48·0	,,	·044	
293			3'—4,	Brown	,,	50·2	,,	·046	
294	,,	61	0'—1'	Light Brown	,,	9·2	,,	·030	Water table at 3 feet.
295			1'—2'	,,	,,	12·8	,,	·025	
296			2'—3'	,,	,,	22·0	,,	·033	
297	Mantapampalli	62	0'—1'	Red	Sandy loam	26·7	Brisk	·045	Rock at 4 ft. Plenty of gravel and stones. Very poor orchard.
298			1'—2'	,,	Gravelly	61·2	,,	·050	
299			2'—3'	Brown	,,	65·1	,,	·050	
300			3'—4'	,,	Loamy	47·8	,,	·048	
301			below 4'		rock	Kankar and shale			

Number of Sample	Area	Village	Pit No.	Depth	Colour	Texture	Stones	Natural reserves of Calcium Corbonate Effervescence with Dil. Acid	Water soluble salts	Remarks
1	2	3	4	5	6	7	8	9	10	11
302	Kodur	Pagadalapalli	63	0'—1'	Red	Sandy loam	1·4	Nil	·019	Deep soil. Kankar
303				1'—2'	,,	Loamy	1·0	,,	·017	below 6 ft. Mango
304				2'—3'	,,	,,	0·7	,,	.016	garden of Sri. Pitchi
305				3'—4'	,,	,,	3·9	,,	·016	Raju.
306				4'—5'	Brown	,,	3·8	,,	·019	
307				5'—6'	,,	,,	10·9	Very slight	·050	
308				6'—7'	,,	,,	58·5	Brisk	·042	
309				7'—8'	,,	,,	42·5	,,	·041	
310		Kapupalli	64	0'—1'	Light Red	Sandy loam	2·0	Slight	·039	Deep soil. Kankar
311				1'—2'	,,	Loamy	1·5	Nil	·039	below 7 ft.
312				2'—3'	,,	,,	0·9	,,	·034	
313				3'—4'	Brown	,,	0·7	,,	·034	
314				4'—5'	,,	,,	3·1	,,	·036	
315				5'—6'	,,	,,	4·7	,,	·043	
316				6'—7'	,,	Gravelly	59·7	,,	·050	
317				7'—8'	,,	,,	83·9	Brisk	·050	
318		Balireddipalli	65	0'—1'	Grey	Loamy	26·7	Slight	·062	Rock at 5 ft. Plenty of
319				1'—2'	,,	,,	21·4	Moderate	·133	ferruginous gravel
320				2'—3'	,,	Clay loam	28·3	Slight	·240	in deeper layers.
321				3'—4'	,,	,,	48·9	Nil	·265	
322				4'—5'	,,	Gravelly	72·0	,,	·315	
323				5'—6'	Loose Conglomerate — pebbles and gravel with calcareous clay as cementing material					
324		Sundramkapu-palli.	66	0'—1'	Red	Sandy loam	0·4	,,	·021	Deep soil.
325				1'—2'	,,	Loamy	1·4	,,	·018	
326				2'—3'	,,	,,	0·9	,,	·016	
327				3'—4'	,,	,,	3·1	,,	·016	
328				4'—5'	,,	,,	3·8	,,	·013	
329				5'—6'	,,	,,	2·4	,,	·015	

330	Sundramkapu-palli	66	6'—7'	,,	,,	1·4	,,	·015	
331			7'—8'	,,	,,	3·9	,,	·013	
332	Peddivaripalli	67	0'—1'	Brown	Loamy	3·1	Nil	·022	Deep soil. Rock at 7 ft. Plenty of ferruginous. Gravel at deaper layers.
333			1'—2'	,,	,,	4·0	,,	·023	
334			2'—3'	,,	,,	8·2	,,	·025	
335			3'—4'	,,	,,	33·6	,,	·031	
336			4'—5'	,,	Gravelly	53·2	,,	·030	
337			5'—6'	,,	,,	62·3	,,	·033	
338			6'—7'	,,	,,	69·1	,,	·036	
339			7'—8'	Very little soil — Practically all stones — quartzite bits.					
340	Kichamma Agraharam	68	0'—1'	Red	Loamy	4·7	Nil	·013	Deep soil.
341			1'—2'	,,	,,	1·2	Nil	·016	
342			2'—3'	,,	,,	2·4	,,	·017	
343			3'—4'	,,	,,	3·2	,,	·015	
344			4'—5'	Brown	Loamy	5·7	,,	·023	
345			5'—6'	,,	,,	17·6	,,	·014	
346			6'—7'	,,	,,	21·7	,,	·015	
347			7'—8'	,,	Gravelly	63·0	,,	·015	
348	Chiyyavaram	69	0'—1'	Red	Loamy	1·2	,,	·011	Deep soil. Water table and rock at 7 ft. Plenty of ferruginous gravel below 5 ft.
349			1'—2'	,,	,,	1·3	,,	·017	
350			2'—3'	,,	,,	3·8	,,	·020	
351			3'—4'	,,	,,	2·9	,,	·019	
352			4'—5'	,,	,,	4·6	,,	·021	
353			5'—6'	Brown	,,	44·8	,,	·018	
354			6'—7'	,,	Gravelly	81·0	,,	·024	
355	Kammavaripalli	70	0'—1'	Light Brown	Sandy loam	3·1	,,	·017	Deep soil. Plenty of ferruginous gravel below 4 ft.
356			1'—2'	,,	,,	5·7	,,	·017	
357			2'—3'	,,	Loamy	3·8	,,	·021	
358			3'—4'	Brown	,,	5·7	,,	·019	
359			4'—5'	,,	Gravelly	76·8	,,	·024	
360			5'—6'	,,	,,	78·5	,,	·026	
361			6'—7'	Red	,,	61·0	,,	·022	
362			7'—8'	,,	,,	64·5	,,	·018	

Number of Sample	Area	Village	Pit No.	Depth	Colour	Texture	Stones	Natural reserves of Calcium Carbonate Effervescence with Dil. Acid	Water soluble salts	Remarks
1	2	3	4	5	6	7	8	9	10	11
363		Anantarajupeta	71	0'—1'	Brown	Sandy	0·3	Nil	·014	Deep soil.
364				1'—2'	"	Sandy loam	0·9	"	·027	
365				2'—3'	"	Loamy	0·4	"	·013	
366				3'—4'	"	"	0·1	"	·016	
367				4'—5'	"	"	0·4	"	·017	
368				5'—6'	"	"	1·6	"	·021	
369				6'—7'	"	"	1·5	"	·034	
370				7'—8'	"	"	3·9	"	·045	
371			72	0'—1'	Red	Sandy loam	2·5	"	·014	Deep soil.
372				1'—2'	"	Loamy	0·9	"	·014	
373				2'—3'	"	"	1·8	"	·017	
374				3'—4'	"	"	1·5	"	·017	
375				4'—5'	"	"	1·8	"	·015	
376				5'—6'	Brown	"	0·8	"	·022	
377				6'—7'	"	"	2·0	"	·021	
378				7'—8'	"	"	7·4	Very slight	·043	
379		Mangampet	73	0'—1'	Brown	Sandy loam	9·9	Nil	·019	Shallow soil. Plenty
380				1'—2'	"	Gravelly	82·2	Nil	·032	of gravel below 1st
381				2'—3'	"	Gravelly	82·7	"	·045	foot Water table at 3 ft.
382		Anantarajupeta	74	0'—1'	"	Loamy	5·3	"	·032	Water table at 4 ft.
383				1'—2'	"	"	2·5	"	·026	
384				2'—3'	"	"	1·1	"	·032	
385				3'—4'	"	"	1·5	"	·048	
386		Settigunta	75	0'—1'	Brown	Sandy loam	3·4	"	·015	Rock at 4 ft. Plenty of
387				1'—2'	"	Loamy	2·1	"	·015	gravel and stones in

388		Settigunta	75	2'—3'	,,	,,	11·9	,,	·019	the last foot of soil. Site
389				3'—4'	,,	,,	43·7	Very slight	·043	in view for land
390				4'—5'	Rock	Red Quartzites				colonization scheme for ex-servicemen.
391		,,	76	0'—1'	Red	Sandy loam	1 7	Nil	·011	
392				1'—2'	,,	,,	4·3	,,	·018	
393				2'—3'	Brown	Loamy	2·0	,,	·015	
394				3'—4'	,,	,,	37·0	,,	·019	
395				4'—5'	,,	,,	25·7	,,	·034	
396		Janakipnram	77	0'—1'	Nil	Sandy loam	1·8	Nil	·009	Deep soil Plenty of
397				1'—2'	,,	Loamy	6·4	,,	·026	gravel from th foot. 4
398				2'—3'	,,	,,	10·7	,,	·017	
399				3'—4'	Brown	,,	14·6	,,	·015	
400				4'—5'	,,	Gravelly	71·8	,,	·012	
401				5'—6'	,,	,,	77·3	,,	·013	
402				6'—7'	,,	,,	76·7	,,	·016	
403		Maisurivaripalli	78	0'—1'	Red	Loamy	6·0	,,	·024	Deep soil. Cheeni garden.
404				1'—2'	,,	,,	4·5	,,	·020	
405				2'—3'	,,	,,	3·8	,,	·030	
406				3'—4'	Brown	Clay loam	1·5	,,	·025	
407				4'—5'	,,	,,	5·9	,,	·035	
408				5'—6'	,,	,,	3·0	,,	·025	
409				6'—7'	,,	Loamy	2·9	,,	·025	
410				7'—8'	,,	,,	3·0	,,	·021	
411	Panyam	Panyam	79	0'—1'	Grey	Sandy	8·7	,,	·025	Mango garden of Sri.
412				1'—2'	,,	,,	2·3	Brisk	·028	P. Madhava Rao.
413				2'—3'	,,	,,	1·4	,,	·036	Deep soil sandy —
414				3'—4'	,,	,,	3·7	,,	·028	water table below
415				4'—5'	,,	,,	3·3	,,	·030	40 feet.
416				5'—6'	,,	,,	2·3	,,	·031	
417				6'—7'	,,	,,	1·1	,,	·037	
418				7'—8'	,,	,,	6·7	Moderate	·022	

Number of Sample	Area	Village	Pit No.	Depth	Colour	Texture	Stones	Natural reserves of Calcium Carbonate Effervescence with Dil. Acid	Water soluble salts	Remarks.
1	2	3	4	5	6	7	8	9	10	11
419	,,	,,	80	0'—1'	Grey	Loamy	4·9	Brisk	·042	Cheeni garden of Sri. P. Madhava Rao. Deep very rich loamy soil.
420				1'—2'	,,	,,	5·8	,,	·046	
421				2'—3'	Black	Clay loam	2·8	,,	·046	
422				3'—4'	,,	,,	2·3	,,	·073	
423				4'—5'	,,	,,	6·4	,,	·049	
424				5'—6'	Brown	Loamy	5·5	,,	·045	
425				6'—7'	,,	,,	1·9	,,	·044	
426				7'—8'	,,	,,	1·3	Moderate	·432	

Extract.

Preventing Soil Erosion — Rebuilding Soil in U. S.

" Incorporation of organic matter adds plant food and erosion resisting characteristics of the soil"—Many farmers of the wheat growing areas of the U. S. Pacific North West have put this into practice and reduced their top soil losses to a minimum. Dr. S. C. Vande Caveye of the Soils Department of the State College of Washington has found that by utilising the stubbles and other crop residues and adding Nitrogen the organic matter level can be raised to something over 3½ per cent soil which has only 3 per cent organic matter can be rebuilt. During the process of rebuilding a great deal of raw humus is left on top of the ground or at plough depth depending on rainfall or other local conditions. As it rots it is an important factor in solving down run off and improving filth of the soil. The farmers at Paulose adopt a croping system wherein they save all their crop residues and add Nitrogen either in the form of legumes grown in rotation or by applying commercial Nitrogen to the stubble. The straw is evently spread over the surface of the fields with straw spreaders and thus making it easier to disc in, plough under, put into the top soil or leave on top as trash, To add Nitrogen Alfalfa or sweet clover is grown. Mixing a grass with legume is still better. (Planters' Journal and Agriculture, Vol. XLI — No. 3, March '49.)

Gleanings.

Plastic Watch Straps. Do They Cause Skin Trouble? Do plastic watch straps cause skin diseases? This allegation, recently raised in the Madras M. L. A., is being hotly argued all over the country. Manufacturers of the plastic material in England and America have been quick to refute the Madras allegation. The British have already proved that their plastic material is 100 per cent safe.

Elaborate research investigations, in England, proved that a British material, "Welvic", is completely free from any toxic hazard. The technical name of the plastic used is polyvinly chloride, or P. V. C. for short.

During the war, many uses were developed for this versatile plastic. One of its spectacular applications was for the manufacture of artificial ears, noses and fingers, for war wounded. It was imperative that the P. V. C. used for these purposes was non-toxic and caused no skin diseases. Manufacturers soon proved to the world that no skin troubles resulted from the wearing of P. V. C. surgical aids for many years of constant use, testify to the complete safety of these compounds.

Advice to the Public. Manufacturers in India should safeguard their interests by ensuring that they use the correct type of compound, namely, materials obtained from highly reliable suppliers. Likewise members of the public, when buying plastic watch straps, can guarantee complete satisfaction and safety by purchasing straps which bear the name of a reputable manufacturer. (I. C. I.)

Crop and Trade Reports.

Statistics—Crop—Gingelly—1948—'49—Fourth or Final Report. The average area under gingelly in the Madras Province during the five years ending 1944—1945 represents 14·7 per cent of the total area under gingelly in India.

2. The area sown with gingelly in 1948—1949 is estimated at 651,800 acres. When compared with the actual area of 638,400 acres according to the Season and Crop Report of the previous year, it reveals an increase of 2·1 per cent. The present estimate reveals a decrease of 4·8 per cent when compared with the average area of 684,900 acres during the previous five years.

3. The estimated area under gingelly in 1948—1949 is the same as the final area in the previous year in Guntur District. An increase in area is estimated in the districts of Vizagapatam, Kurnool, Bellary, Anantapur, Nellore, Chittoor, North Arcot, Salem, Coimbatore, Ramnad, Tirunelveli and South Kanara and a decrease in area in the other districts of the Province. The decrease is marked in Chingleput (—6000).

4. The yield per acre is estimated to be normal in Krishna and Guntur and below the normal in all the other districts of the Province due mainly to adverse seasonal conditions. The condition of the late sown crop is reported to be generally satisfactory. The seasonal factor for the Province as a whole works out to 85 per cent of the average as against 82 per cent estimated in the Season and Crop Report of the previous year. On this basis the total yield works out to 75,800 tons which is more than that estimated in the Season and Crop Report of the previous year by 5·1 per cent. The present estimate shows a decrease of 5·5 per cent, when compared with average yield of 80,200 tons during the previous five years.

5. The wholesale price of gingelly seed per imperial maund of 82. 2/7 lbs. (equivalent to 3200 tolas) as reported from important markets on 9—4—1949 was Rs. 35—4—0 in Salem, Rs. 32—15—0 in Tirunelveli, Rs. 32—3—0 in Tuticorin, Rs. 31—6—0 in Cuddalore Rs. 30—12—0 in Rajahmundry, Rs. 30—1—0 in Kakinada and Rs. 27—1—0 in Vizagapatam. When compared with the prices which prevailed on 8—1—1949, these prices reveal a rise of 16 per cent in Salem 12 per cent in Tuticorin, 11 per cent in Rajahmundry, 9 per cent in Kakinada, 5 per cent in Tirunelveli and 2 per cent in Cuddalore and Vizagapatam. (From Public and Economic Statistics Department).

Cotton Raw, in the Madras Presidency (in bales of 392 lbs.) The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 to 29—4—1949 amounted to 70934 bales of 392 lbs. lint as against an estimate of bales of the total crop of 1949. The receipts in the corresponding period of the previous year were 113582 bales. 145861 bales mainly of pressed cotton were received at spinning mills and 1656 bales were exported by sea while 41755 bales were imported by sea mainly from Karachi and Bombay. (From the Director of Agriculture, Madras).

Weather Review—For April 1949.

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	0·5	—0·2	0·5
	Calingapatam	Tr.	—0·7	0·4
	Vizagapatam	0·2	—0·5	0·6
	Anakapalle*	2·0	+1·0	2·2
	Samalkot*	0·5	—0·8	0·5
	Kakinada	2·1	—0·4	2·2
	Maruteru*	0·3	—0·1	0·3
	Masulipatam	0·4	—0·3	0·4
	Guntur*	0·5	—0·5	0·5
	Agrl. College, Bapatla	0·5	—0·3	0·5
	Veeravanam (College Farm)	0·4	... x	0·4
Ceded Dists.	Kurnool	1·5	+0·8	1·5
	Nandyal*	0·7	—0·1	0·7
	Hagari*	0·7	—0·5	0·7
	Siruguppa*	Nil	—0·7§	Nil
	Bellary	Nil	—0·8	Nil
	Rentichintala	0·2	...	0·2
	Cuddapah	Nil	—0·6	Nil
	Anantharajpet*	0·1 y	—0·4	0·1
Carnatic.	Nellore	0·4	—0·1	1·4
	Buchireddi-palem*	Nil	—0·7	Nil
	Madras	0·9	+0·3	0·9
	Tirurkuppam*	Nil	— 1·9$	Nil
	Palur*	Nil	— 2·4	Nil
	Tindivanam*	0·5	—0·7	0·5
	Cuddalore	0·1	—0·9	0·1
Central.	Vellore	1·5	+0·5	0·5
	Gudiyatham*	Nil	—0·8	Nil
	Salem	5·8	+3·9	5·9
	Coimbatore (A. C. R. I.)*	1·3	—1·4	1·4
	Coimbatore (C. B. S.)*	1·1	—1·8	1·1
	Coimbatore	1·5	—0·1	1·5
	Tiruchirapalli	1·1	—1·3	1·2

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	0·1	—1·0	0·6
	Aduturai*	Nil	—2·7	Nil**
	Pattukottai*	1·0	—2·0	1·4
	Mathurai	5·9	+3·7	6·8
	Pamban	0·6	—1·2	6·8
	Koilpatti*	0·5	—3·1	2·4
	Palamcottah	0·9	—1·6	1·8
	Amba-samudram*	2·6	—1·2	3·8
West Coast.	Trivandrum	4·0	—0·6	4·3
	Cochin	6·1	—1·2	6·5
	Calicut	9·5	+4·7	9·6
	Pattambi*	2·6	—0·9	2·6
	Taliparamba*	1·3	—1·5	1·3
	Nileshwar*	2·1	—0·6	2·1
	Pilicode*	1·3	—1·7	1·3
	Mangalore	Nil	—1·9	Nil
	Kankanady*	Nil	—1·8	Nil
Mysore & Coorg.	Chitaldrug	0·3	—0·7	0·3
	Bangalore	1·6	Nil	1·9
	Mysore	2·1	—0·2	2·1
Hills.	Mercara	3·0	+0·4	3·1
	Kodaikanal	2·5	—2·3	3·5
	Coonoor*	5·7	+0·2	5·7
	Ootacamund*	2·2	—2·8	2·2
	Nanjanad*	2·2	—2·9	2·2

Note :— (1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal

(3) $ Average of six years data for Tirurkuppam, and seven years for Pilicode is given as normal.

(4) ** Actual figure is 0·03".

(5) (y) Actual figure is 0·05".

(6) § Taluk office normal is 0·95".

(7) x Readings are being recorded only from February 1948.

(8) Tr. Trace, i. e., Rainfall below 0·04".

(9) ... Figures not available.

Weather Review for April 1949

The month began with a shallow low over Gangetic West Bengal and the neighbourhood and this 'low' became unimportant on the third day of the month.

The seasonal trough of 'low' pressure was found established over Chota Nagpur and neighbourhood even in the first week of the month.

The begining of the second half of the month was characterised by the appearance of a shallow 'low' over South Bihar and the East United Province.

A depression was noted on 22—4—1949 in the southeast and the adjoining east Central Bay of Bengal with its central region lying this morning near Lat. 12°N, Long. 90°E. It was expected to intensify and move northwest. Apparently it crossed the coast near Sandyway on the third day.

Practically throughout the second half of the month Cuddapah was recording high maximum temperature in the range of 104 to 110°F. Places like Kurnool, Nellore and Rentachintala were also recording high maximum temperatures but not so continuously as Cuddapah. In short, severity of summer was felt practically throughout the Madras Presidency. Night temperatures happened to be invariably above normal in many parts of the Presidency.

Fairly widespread thundershowers occurred in different parts of the Presidency. The note-worthy falls in the month are as detailed below :—

Date.	*Place.*	*Rainfall in inches.*
4—4—1949	Salem	2·1
,,	Vellore	1·3
7—4—1949	Madura	2·0
8—4—1949	Calicut	4·8
18—4—1949	Cochin	2·7

M. B. V. N. & C. B. M.

ANDHRA UNIVERSITY

The following is the provisional list of Register Numbers of successful candidates at the under-mentioned Examinations held in March—April 1949.

B. Sc., Degree Examination in Agriculture.

First Examination :— 1, 2, 3, 4, 6, 8, 11, 12, 14, 18, 19, 20, 21, 22, 23, 25, 30, 36, 37, 39, 40, 43, 45, 47, 48, 49, 51, 54, 55, 57, 58, 60, 61, 62, 63, 65, 68, 71, 76, 80, 83, 84, 85, 72, 75.

Passed in Agriculture :— 9, 10, 13, 17, 24, 27, 28, 38, 42, 46, 53, 56, 59, 66, 69, 70, 73, 74, 79, 81, 82, 86.

Passed in Botany :— 5, 9, 13, 17, 24, 27, 28, 32, 35, 42, 46, 52, 53, 56, 59, 66, 69, 70, 73, 74, 77, 79, 81, 82, 86, 87, 88, and 89.

Passed in General and Soil Chemistry :— 5, 9, 13, 17, 24, 28, 32, 35, 38, 42, 46, 52, 53, 56, 66, 67, 69, 70, 73, 74, 77, 79, 82 and 86.

Passed in Zoology:— 5, 9, 10, 13, 24, 27, 28, 32, 35, 38, 42, 46, 52, 56, 59, 66, 69, 70, 73, 74, 77, 79, 81, 82 and 86.

Passed in Agricultural Engineering (Civil):— 5, 17, 32, 35, 38, 52, 53, 59, 77, 81 and 88.

The results of the following candidates will be announced later.

7, 15, 16, 26, 29, 31, 33, 34, 41, 44, 50, 64 and 78.

Second Examinotion:— 90, 91, 92, 93, 94, 96, 97, 98, 99, 100, 101, 103, 104, 105, 106, 107, 108, 110, 111, 112, 114, 115, 117, 118, 120, 121, 122, 125, 126, 127, 128, 131, 132, 134, 136, 137, 139, 140, 142, 143, 144, 148, 149, 150, 151, 152, 153, 154, 156, 157, 160, 161, 162, 163, 165, 166, 167, 168, 169, 170. 171, 172, 174, 175, 176, 177, 178, and 179.

Passed in Agriculture—Plant Husbandry:— 95, 109, 113, 116, 119, 123, 124, 129, 130, 133, 135, 138, 141, 145, 146, 147, 155, 158, 159, and 164.

Passed in Agricultural—Botany. (Crop Botany and plant Breeding and genetics):— 95, 109, 113, 116, 124, 141, 145, 146, 147, 155, 158, 159, and 181.

Passed in Agricultural Chemistry. (Organic Chemistry and Plant Chemistry):— 119, 123, 141, 159, and 164.

Passed in Agricultural Entomology:— 95, 109, 113, 116, 119, 123, 124, 129, 130, 133, 135, 138, 141. 145, 146, 147, 155, 158, 159, 164, 173 and 181.

Passed in Agricultural Engineering (Mechanical);— 95, 109, 113, 116, 119, 123, 124, 138, 145, 146, 147, 155, 158, and 164.

Final Examination (Second Class):— 182, 184, 185, 186, 187, 188, 190, 191, 192, 193, 194, 195, 196, 197 199, 200, 201, 202 to 206, 208, 209, 211, to 215, 217, to 225, 227, to 230, 234, to 244, 246, 247, 249 to 260, 262, 263, 264, to 269, 271, 272, 274, and 275.

Passed in Agriculture — Horticulture:— 183, 189, 216, 226, 231, 232, 248, and 273.

Passed in Agriculture—Economics and Farm Management:— 183, 189, 207, 210, 216, 226, 231, 232, 233, 248, and 270.

Passed in Agriculture — Animal Husbandry and Dairying:— 231, 233, 245, 248, 261 and 273.

Passed in Botany (Plant Pathology):— 183, 189, 216, 226, 232, 273, 277 and 278.

Passed in Agricultural Chemistry:— 183, 189, 198, 207, 216, 226, 231, 232, 245, 248, 270, 273, and 279.

Passed in Animal Hygiene:— 183, 189, 207, 226, 231, 232, 233, 248, 273, 277, and 279.

Departmental Notifications.

GAZETTED SERVICE—POSTINGS AND TRANSFERS.

Name of Officers	From	To
Sri Dharmalingam Mudaliar,	Retired Dy. D. A.,	Provincial Biochemist for compost Development, Madras.
,, Francis, T. S.	Gazetted Assistant Office of D. A., Madras,	D. A. O., Trichinopoly.
,, Jeevan Rao, M.	P. A., to D. A., O., Bellary,	Assistant Marketing Officer, Madras.
,, Krishnamurthi, C.	Assistant Entomologist, Nellikuppam,	Gazetted Assistant to Lecturer in Entomology, Bapatla.
,, Krishnamurthi Iyer, K. S.	P. A., to D. A. O., Pattukottai,	D. A. O., Tanjore.
,, Lakshmipathi Rao, T.	Special A. D., Sugarcane Development Board, Ramachandrapuram,	D. A. O., Anantapur.
Janab Mohammad Basheer Sahib	Lecturer in Entomology Agricultural College, Bapatla,	Assitant Entomologist (Sugarcane pest scheme) Nellikuppam.
Janab Mohammad Abbas, U. B.	D. A. O., Saidapet,	Assistant Marketing Officer, Madras.
Janab Mohammad Adeni Sahib,	D. A. O., Chicacole,	Dy. D. A., Vizagapatam.
Sri Rama Mohan Rao, A.	Assistant Marketing Officer, Cuddapah,	D. A. O., Anantapur.
,, Ramakrishna Rao, K. L.	Special A. D., Crop Cutting Experiments, Tanjore,	D. A. O , Nellore.
,, Raman Menon, K.	A. D., Ponnani,	D. A. O., Salem.
,, Ramana Rai, K. S.	Special A. D., Sugarcane Development Scheme, Mangalore,	D. A. O., Saidapet.
,, Srinivasa Ayyangar, S. R.	Special Duty on Compost Work,	Gazetted Assistant to Lecturer in Agriculture, Coimbatore.
,, Subramania Sharma, A. H.	Gazetted Assistant to Lecturer in Agriculture, Coimbatore.	Assistant Marketing Officer, Coimbatore.
,, Satagopan, V.	Assistant Marketing Officer, Coimbatore,	Dy. D. A., Cuddapah.
,, Varadachary, K.	D. A, O., Trichinopoly,	Gazetted Assistant Office of the D. A., Madras.
,, Venkataraman, K.	Dy. D. A., Vizagapatam,	Dy. D. A., Guntur.
,, Viswanatha Reddy, D.	Under Training at Sholapur Institute,	Assisting Marketing Officer, Cuddapah.

SUBORDINATE SERVICE

APPOINTMENTS

The following candidates are appointed to the posts shown against each.

Names	To
Sri Appalanarasimham, J.	Assistant in Chemistry, Coimbatore.
,, Hanumantha Rao, M.	Assistant in Cotton, Palur.
,, Krishna Rao, R.	Assistant in Entomology, A. R. S., Siruguppa.
,, Koteswara Rao, K.	A. D., Hospet.
,, Lakshminarayana, K.	Assistant in Cotton, Adoni.
,, Nagaeswara Rao, M.	A. D., Virdachalam.
,, Nagi Reddi, M.	Assistant in Oilseeds, Tindivanam.
,, Rajanna, B.	A. D , Nannilam.
,, Raghava Rao, N.	A. D., Tadpatri.
,, Rama Koteswara Rao, G	Assistant A. R. S , Pilicode.

TRANSFERS AND POSTINGS.

Name of Officers	From	To
Sri Antony, J. S, C.	A. D., Papanasam,	A. D , Tobacco Scheme, Sendarampatti.
,, Ananthachari, P. S.	A. D., (on leave),	A. D., Maduranthakam.
,, Bhagirathi Padi, P.	A. D., Parvatipur,	A. D., Padapatnam.
,, Divakaran, K.	Assistant in Plant Physiology Bapatla,	Assistant in Millets, Coimbatore
,, Gavurangamurthi, K. V.	A. D., Ramachandrapur,	A. D., Ramachodavaram.
,, Gopalakrishnan, A.	A. D., Patapatnam,	A. D., Chodavaram.
,, Krishnamurthi, G.	A. D., Avanigadda,	F. M., Nandyal.
Miss Kunjamma, V. K.	Assistant in Millets, Coimbatore,	Assistant in Chemistry, Coimbatore.
Sri Kulasekharan, C. R.	Special A. D., C. M. P., Ayangudi.	A. D., Peravurni.
,, Konda Reddi, G.	A. D., Tadapadri,	P. A., to D. A. O., Anantapur.
,, Lakshmipathi Rao, S.	A. D., Madurantakam,	Teaching Assistant in Botany, Bapatla.
,, Mohammad Maqbaloor Rahiman,	P. P., Assistant Nellore,	Assistant in Plant Physiology, Bapatla.
,, Madhava Rao, S.	Special A. D., Crop Cutting Experiments, Vellore,	A. D , Chingleput.
,, Mohammad Baig,	On leave,	A. D., Polavaram.
,, Mahadeva Iyer, S.	A. D., on leave,	Special Crop Cutting Experiments, Tanjore.
,, Mohammad Fajiuddin	A. D., Nelayagiri,	A. D., Anakapalle.
,, Nagarajan, K. R.	On leave,	Assistant in Entomology, Nellikuppam.

	Name of officers	From	To
Sri	Narayanan, K. M.	F. M., Botanical Gardens, Ooty,	Military Department.
,,	Narayana, N. G.	Cotton Assistant A. R. S., Koilpatti,	Assistant in Cotton, Coimbatore.
,,	Parameswara Menon,	F. M., A. R. S., Taliparamba,	Special A. D., Crop Cutting Experiments, Calicut.
,,	Raja Rao, G.	Chemical Assistant Malt Factory Coimbatore,	Analytical Chemist, Coimbatore.
,,	Rama Rao, P. V.	A. D., Chodavaram,	A. D., Puthur.
,,	Rama Rao, M.	Assistant Biochemist, Kodur.	Assistant in Cotton, Palur.
,,	Radhakrishnan, T. V.	Cotton Assistant Coimbatore,	Cotton Assistant A. R, S., Koilpatti.
,,	Suryanarayana, T.	A. D., Polavaram,	A. D., Avanigodda.
,,	Sivasankaran Nair, K.	Assistant in Chemistry, Coimbatore,	Chemical Assistant (Malt). Coimbatore.
,,	Seshadri, T. V.	Under Training Sholapur Institute,	P. P. Assistant (Entomology) Chittoor.
,,	Srinivasan, C.	P. P. Assistant (Mycology) Chittoor,	P. P., Assistant (Entomology) Cuddalore.
,,	Suryanarayana, Y.	A. D., Hospet,	A. D., Udayagiri.
,,	Sivasankaran Nair,	Special A. D., Crop Cutting Experiments Calicut,	F. M., A. R. S.. Taliparamba.
,,	Subbaraya Sastri, K.	A. D., Ramachodavaram,	A. D., Ramachandrapuram.
,,	Suryanarayana, K.	Special A. D., For Production of Tobacco Seed, Guntur.	A. D., Parvatipur.
,,	Satyanarayana, T.	A. D., Tobacco Scheme, Sendarampatti,	Assistant in Cotton, Palur.
,,	Sankaran Unni, T.	Botonical Assistant, Ootacamund,	F. M., Botanical Gardens,
,,	Suryaprakasa Rao, P. V.	On leave,	Assistant to Biochemist, Kodur.
,,	Venkataramanappa, S.	A. D., Puttur,	Special A. D., Crop Cutting Experiments, Vellore.
,,	Venkatarama Reedi, T.	F. M., Sugarcane Liaison Farm, Hospet,	P. P., Assist (Mycology) Nellore.
,,	Viswam, K. E.	Marketing Assistant, on leave,	A. D., Virdachalam.

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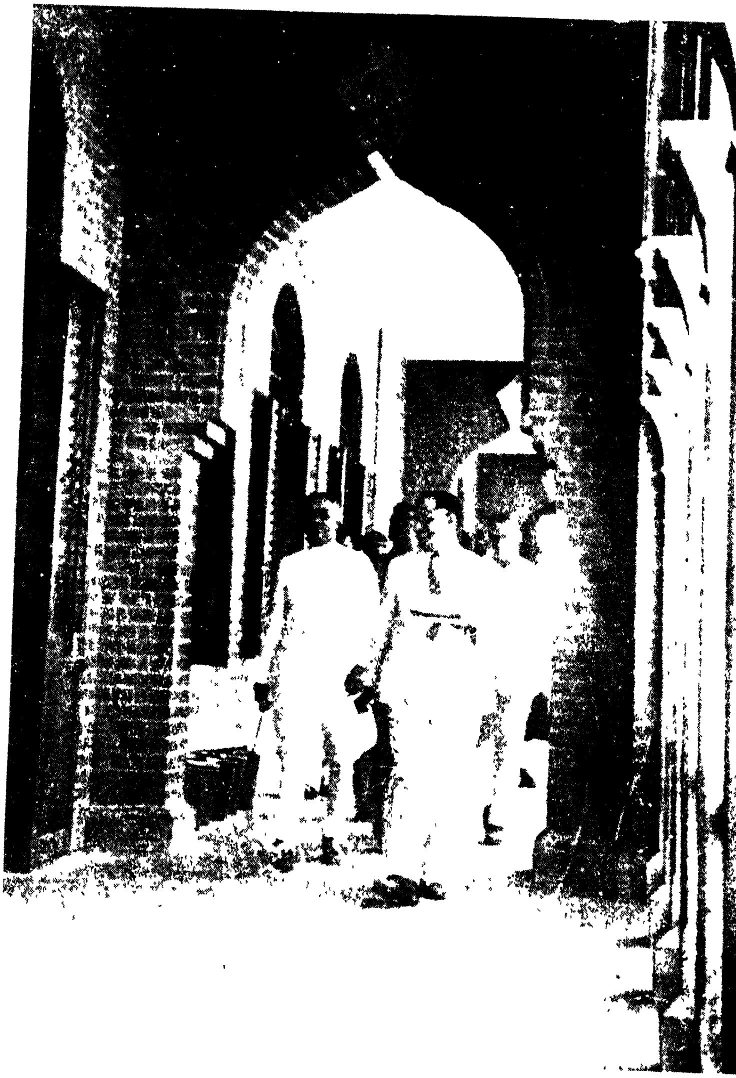

His Excellency The Maharaja of Bhavnagar, Governor of Madras was shown round the college on 13-6-1949

The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI June 1949 No. 6

Editorial

Model Farms: Speaking at a conference of businessmen of Nagpur Mr. Ratanchand Hirachand, a Bombay industrialist has made the interesting suggestion that the Provincial Governments should in the event of the abolition of the Zamindari system, take over the land themselves and organise agriculture on sound business lines instead of leaving it in the hands of small cultivators. We offer no comment on the political aspect of the question but there is much to be said in favour of large scale farming either by Government or other agencies in the interests of national economy.

The need for exploring the possibilities of organised large scale farming is now greater than ever before, as according to the final decision of the Government of India, all food imports should cease by 1951.

Two factors more than any other have been responsible for the slow progress of the Agricultural Industry in this country. They are lack of capital for investment on improvement of land and its scientific cultivation on modern lines and lack of enterprise on the part of cultivators, an inevitable consequence of their general poverty. The high cost of modern agricultural machinery and equipment the risk involved in taking up new methods precluded the ordinary cultivator from deriving any benefit whatsoever from the progress of agricultural research. The situation is not much changed even to-day in spite of strenuous efforts for the last few years, of the entire Governmental machinery to make him interested in agricultural improvements. The plantation crops like Tea and Coffee and Tobacco in the Circars have been raised on commercial lines and yielded high dividends, showing what capital and organisation could do to make farming a paying proposition. Recent developments in the Coimbatore District where large scale farming has been attempted by individuals with adequate capital at their disposal have shown that farming even

of food crops will pay in the long run if proper attention is paid to permanent land improvement. In these cases production has been increased manifold and both the owners of the land and the community at large have been benefitted. No attempt has been made by Government in any of the Provinces so far, as we are aware, to raise crops on a commercial basis. All the Agricultural stations and Government Farms have been maintained either for research or educational purposes.

The time appears opportune for undertaking large scale enterprise in commercial farming both by Government and other agencies with adequate capital and a capacity for organisation. The Agricultural Colleges are turning out each year more Graduates than could be absorbed by the Agricultural Departments, and these would provide the technical personell required to run these farms.

Large farms run on modern lines by Government, besides bringing increased returns themselves would be serving as model farms to other cultivators, who are now apathetic towards improved agriculture. The country as a whole will therefore benefit by this enterprise.

The suggestion of Mr. R. Hirachand would therefore appear to merit the serious consideration of the Government.

Effect of Summer Ploughing on the Germination of Korai Weed (Cyperus Rotendus)

By

P. KRISHNA RAO,
Millet specialist, Coimbatore

and

MISS. L. MOSES
Assistant to Millet Specialist

At the Millets Breeding Station, Coimbatore, certain fields were very badly infested with the Korai weed (Cyperus). The fields are red sandy loams. The rainfed crop of Cumbu (Pearl millet) in Field No. 2 was harvested towards the middle of January 1949, and the field was deep ploughed on 24—1—1949 The ploughing was done by the turn-wrest plough drawn by 2 pairs of bullocks. The depth of furrows varied from 7 inches to 8 inches. Large clods were lifted by the plough The ploughing was done closely so that there was no unploughed land left behind. From 24—1—1949 till 9—3—1949 (i.e. about 45 days) the field was fallow and in a cloddy condition and received no cultivation being fully exposed to dry weather The sun and wind had their full play on the ploughed field. The range of temperatures during the months January, February and March along with the rainfall conditions are given below :—

Month	Mean Maximum	Mean Minimum	Lowest Minimum	Highest Maximum	Date on which lowest min. was recorded	Date on which highest max. was recorded	Rainfall in inches.
January	84·5	61·6	52·8	88·8	20th	30th	nil
February	90·1	62 9	36·0	95·0	20th	23rd	nil
March	95·7	65·7	58 8	100·4	12th	15th	nil

There was no rain during the period. Advantage was taken of this condition to study if the tubers of Korai left in the ploughed field retained germination capacity after this period of dessication in the field. 10 tubers of cyperus were picked from the ploughed field at random on 9—3—1949 i. e. 45 days after ploughing. 10 bulbs were also picked on 9—3—1949 from an unploughed portion of the field and both the sets of bulbs were kept for germination in a pot. Every tuber picked from the unploughed land germinated and gave a number of

sprouts from each tuber while those picked from the ploughed field completely failed to germinate. A similar picking was made on 24—3—1949 (i. e. 60 days after ploughing) in which also all the tubers picked from the unploughed field germinated while there was no germination at all from those picked from the ploughed field as shown below :—

Germination test of Cyperus tubers from ploughed and unploughed fields (Ploughing on 24—1—1949.)

	I set sown on 9—3—1949.		*II set sown on 24—3—1949.*	
	From unploughed field	From ploughed field	From unploughed field	From ploughed field.
Tuber No.	No. of sprouts from each tuber	No. of sprouts from each tuber	No. of sprouts from each tuber	No. of sprouts from each tuber.
1	One sprout		1 One sprout	
2	Two sprouts		2 One ,,	
3	Two ,,		3 One ,,	
4	Two ,,	Germination	4 No sprout	Germination
5	Two ,,	nil	5 Three ,,	nil
6	One ,,		6 One ,,	
7	One ,,		7 One ,,	
8	Two ,,		8 One ,,	
9	Four ,,		9 One ,,	
10	One ,,		10 Two ,,	

The pots were sown on 9—3—49 and 24—3—49 and were watered daily. Within 10 days of sowing all the tubers picked from the unploughed field germinated vigorously. The watering was continued for 1½ months for both the sets of pots. There was no germination at all in the pot in which tubers picked from the ploughed field were sown, while in the pot in which tubers from unploughed field were sown, the cyperus plants have come to flower.

The tubers picked from the ploughed field after 45 and 60 days of exposure in the field after ploughing, were somewhat shrivelled and when broken showed mealy contents. The fresh bulbs picked from unploughed fields were full and fresh and when crushed showed hard moist contents like kernel. Both of them had the same flavour.

Deep ploughing in summer with a mould-board plough and subsequent exposure to sun for a period of 45 days without rain completely killed the cyperus bulbs that were present in the depth of ploughed soil in the fields. These months are usually rainless months in this tract. It is not claimed that deep ploughing kills all the Korai tubers in the entire depth of soil in the field. It is well known that korai tubers are deposited at greater depths in the soil than 8 inches which is the depth of ploughing in this case. The tubers deposited deeper than the ploughing depth, in course of time and with the help of sub soil moisture or subsequent rains, make their appearance in the field. These can only be controlled by working the blade harrow periodically as they come up. But a large mass of them have already been killed by the deep summer-ploughing, as a majority of tubers are located in the top 6 inches of soil. The object of this paper is to draw attention to the function of deep summer-ploughing in the control of cyperus weed occuring in the red sandy loams

A Note on Calcining of Bones as a Village Industry

By

SRI K. RANGASWAMY, B. Sc., (Ag.)
(Personal Assistant to the District Agricultural Officer, Chittoor)

Manuring of crops for increased production without disproportionate increase in the cost of production is aimed at by all producers, and in this endeavour, simple process of conversion of bones as a cheap phosphatic manure is presented below for adoption in villages. By a judicious combination with, green manures, compost, farm yard manure, oil-cakes and nitrogenous fertilisers, it has been established, that the phosphate manure plays a very important role in higher crop yield. Different crops remove from the soil varied quantities of phosphates, and unless the loss is recouped, the gradual decline in fertility with consequent low yields will be obvious. The Government in their Government Order No. 2693, dated 10—7—'46 ordered publication of work on calcination for the benefit of ryots. This article it is hoped, will stimulate the village Industry and benefit the ryots.

Cheap and simple process of phosphate manufacture:

Though raw bone is easy to collect and cheap in the villages, by the time it reaches the cultivator as bonemeal it becomes too expensive for the cultivator. The raw bones are hard and by a simple process they can be rendered brittle. The factory process involves sulphuric acid treatment which is expensive and requires scientific knowledge. The process described below needs paddy husk, or groundnut husk or saw dust or chaff of grain which are available in the villages. The village tanner has no use for the bone. He throws them away. The agriculturist should see that he utilises the bones of his cattle as much as he cares for the hides by adopting the simple process. Three processes are described below :

A. Heap process:

A layer of bones is laid flat and round on a bedding of husk. A row of bricks is arranged leaving a 6″ wide and 4″ high gap along the diametre for air inlet or outlet. This channel should be in line with the direction of the wind of the season. The channel is covered with parallel arrangement of bones. Husk is spread over this and another layer of bones is arranged. Again this is covered with husk. All the bones are put similarly one over the other forming into a steep pyramid. In this arrangement hard bones of the legs and the vertebra should be placed in the centre, and light bones like the ribs and skulls towards the sides, because as the heat moves up, the former would get sufficient heat at the centre and the latter less heat at the sides. Heat is thus uniformly utilised and there may remain no unburnt or over burnt bones when done

with. When all the bones are piled up a final layer of husk is spread and a 3″ thick moist earth put all over the heap, leaving the inlet and outlet at the base. One-fourth the weight of the bones is the husk required. Fire is introduced in at the inlet. The husk and the bones inside catch fire after a few minutes. In about an hour copious smoke with characteristic odour will emit which is a sign that brisk heat is at work. Now close the bottom smoke outlet and open 3 or 4 small outlets on the top of the pyramid. The heat is thus forced upward and the smoke will now emit at the top holes. If the wind blow is fast, regulate the air inlet at the bottom with a brick. All that is required is, steady heat; too much heat will result in more of calcium carbonate and loss of phosphate. The process should not be hurried through. In three or four days the process will be complete. During the course of the second day a few cracks may develop on the heap which should be closed up then and there with mud. The completion is indicated by the absence of smoke at the outlets and the heap is luke-warm to touch. The mud plaster is removed. Properly heated bones are ashy brown in colour, over heated ones, white, and imperfectly heated ones, black. The bones are now quite brittle and can be powdered in mortar and pestle or rolled in chunam mortar.

B. Cattle kiln process:

Like the *chunam* kiln a permanent structure with unburnt bricks or stones is suggested when continuous manufacture is needed. A kiln 4′ in diametre and 5′ in height will hold a ton of bones. As in the heap process the bones are piled up till they are a foot above the wall, and the top portion mud plastered. A few smoke exit holes are made at the top. Due to the vertical move of the heat calcining is effected quicker than the heap process. The air inlet at the base of the kiln can be used to remove the calcined bones. After removal the kiln is ready for the next charge.

C. Conduction heat process:

In the above two processes, the bones come in direct contact with fire and the resultant product loses 3% nitrogen. To minimise this loss it was devised to render the bones brittle enough by heat conduction. The bones are arranged in several narrow rows parallel and close to one another. An inch of wet-earth is put over the bones. It was noticed above, two and a half times the weight of bones is the quantity of husk required. Fire is set to the husk in line with the direction of the wind. The husk as it burns conducts the heat to the bones inside through the thin layer of mud plaster. When groundnut husk is used it should be moistened with water lest it should run into flames and thus burn away quickly. The burning must be slow and steady. When the husk is completely burnt the mud plaster is removed. The bones are brittle but not so

brittle as in (a) and (b) processess. On analysis 2·5% nitrogen is retained, but the total and citric soluble $P_2 O_5$ contents are less than the other two products. It is easier to adopt the heap and the kiln processes, and the loss of nitrogen is minimised by reducing the quantity of husk used.

Analysis:

Head of analysis	L. No. 340 Air dry basis	L. No. 340 Moisture Free basis	L. No. 341 Air dry basis	L. No. 341 Moisture Free basis	L. No. 342 Air dry basis	L. No. 342 Moisture Free basis	L. No. 343 Air dry basis	L. No. 343 Moisture Free basis	L. No. 344 Air dry basis	L. No. 344 Moisture Free basis
Moisture	3·74	...	3·08	...	3·29	...	3·83	...	2·53	
Loss on ignition	9·21	9·57	19·67	20·30	20·23	20·92	16·87	16·85	6·21	6·37
Insolubes	0·85	0·89	1·09	1·12	0·82	0·85	2·03	2·09	1·49	1·53
Nitrogen	1·12	1·16	2·54	2·52	2·48	2·56	2·05	2.11	0·45	0·47
Total $P_2 O_5$	36·00	37·41	31·47	32·46	32·22	33·25	32·72	33·67	37·24	38·20
2% citric soluble $P_2 O_5$	26·11	27·13	24·74	25·50	24·36	25·20	25·70	26·45	22·56	23·15

Cost of Production: At the outset it may be said the village should be the centre of manufacture of the manure. Village labour may be employed for the collection of the bones and doing the rest of the job. This will give them additional income. At present the bone collectors are advanced small sums by the town agents of the bone exporting concerns and head loads of bones are brought to the agent's depot in the town. The head-loads are cursorily judged, of their weight, or weighed with a hand spring balance. Deductions for moisture in the bones from 40% to 60% are made and the head-load fetches Rc. 0—4—0 to 0—8—0 per 56 lbs.

Below the details of cost of production include the cost of bones purchased in Nellure Town and the labour costs and other charges incurred. In actual practice the value can be roughly put at half or even less than the figures given below :

A. Particulars 1943.	Value.
Cost of 2,126 lbs. of raw bones	Rs. 50—0—0
Carting to work site	2—8—0
Cost of paddy husk-332 lbs. (1/4 the weight of bones will suffice)	2—8—0
Weighing the bones and arranging them in heap	2—8—0
Watchman, weighing the final produce	1—4—0
Powdering in mortor and pestle	2—4—0
Total	Rs. 61—0—0

2,126 lbs. of raw bones yielded 1,400 lbs. of calcined bonemeal. Therefore 1,400 lbs. costs Rs. 61/- which works out to Rs. 97—9—7 or Rs. 98/- per ton or Rs. 4—9—5 per cwt.

B. Demonstration in 1947. at Madaraju-gudur (Nellure Taluk).

Particulars.		value.
Cost of bones 15,500 lbs.	Rs.	519—0—0
Cost of paddy husk 6,500 lbs.		16—0—0
Weiging bones and husk		0-12—0
Heaping and plastering		6—0—0
Fixing and weighing		0-12—0
Removing the heap and weighing		3—8—0
Total	Rs.	546—0—0

15,500 lbs. raw bones yielded 9,920 lbs. of calcined bones.

Therefore recovery = 64%.

Cost of 9.920 lbs. of calcined bones	Rs.	546—0—0
Cost per ton	Rs.	122-10—0
Cost per cwt.	Rs.	6—2—0 or
	Rs.	6—3—0

I feel the authorities would be convinced that decentralization of bone utilisation so as to limit the collection and use within each taluk area would be cheaper than centralizing bonemeal manufacture at a few Provincial factories.

A comparative analysis figures of the following phosphatic manures show that calcined bonemeal has good percentage of total and citric soluble P_2O_5. The market prices and the unit prices of the P_2O_5 are compared. The fear of competition and consequent reduction of costs of factory made phosphates need not be entertained as the method of procurement of bones in the villages, the simple process employed in its preparation, and, the absence of costly technical guidance remain the factors in its favour.

Comparative Analysis of Different Phosphates and Unit Prices:

The unit prices worked out below clearly show that calcined bonemeal is the cheapest of all phosphatic manures and therefore worthy of general adoption in villages.

Kind of phosphatic manure.	nitrogen %	Total P_2O_5.	Citric soluble P_2O_5 % to total P_2O_5.	Market value per ton.	Unit prices.
Steamed bonemeal	4·4	23·6	50	Rs. 160/-	Rs. 6-12-6
Bone super ordinary	...	22·0	...	200/-	9—1-6
Bone super concentrated	...	43·0	95	300/-	7—0-0
Basic slag	...	17·2	80	200/-	...
Rock super	...	16·1	...	200/-	...
Calcined	0·47	38·20	...	...	...
Bonemeal	0·56	33·25	...	98/-	3-10-0

The value and the unit price of calcined bonemeal in actual practice will be a fourth in the villages where the value of bones is negligible, and the waste material and labour are part and parcel of the cultivation.

Below is given the analysis of calcined bonemeal from different demonstrations in Nellore District. It may be seen that P_2O_5 could be maintained at about 38%.

	L. No. 373. (a)	L. No. 929. (b)	L. No. 930. (c)	L. No. 931. (d)	L. No. 932 (e)
Moisture content	2·64	4·73	5·71	6·22	3·50
Loss of ignition	2·99	1·55	19·28	8·48	1·74
Insolubles	1·24	0·41	1·05	1.12	1·13
Nitrogen	...	0·11	2·04	0·98	0·14
Phosphoric acid	37·15	37·88	29·72	33·28	37·54

Samples (a) (b) and (e) are grey in colour and contain only small quantities of nitrogen and organic matter, indicating calcination has been complete. Sample (d) is dark grey in colour and sample (c) is almost black in colour at the bone chard stage.

Bones which are merely charred are less readily decomposed in the soil than completely calcined bones.

Grain Storage at Avadi

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The following is an account of the measures adopted at Avadi for the proper preservation of the large quantities of food grains that are received for storage as Provincial Reserve stocks. Twenty-five sheds with a storage capacity of 3,500 tons each are in use for this purpose. They are of the hanger design and of three different types, the Lahore, the Indian and the Avadi type

Each had a cement concrete floor of about 330 x 100 sq. ft The roofing was semi-circular, 18 ft. high and formed of galvanised iron sheets. Valley gutters were provided between two bays for drainage. These were lined with prefabricated bituminised rolls supported on wooden planks to prevent leakage. Each shed had eight double doors, one on either side of each bay, opening outwards over a platform running over the whole length of the shed Drains were provided along the margins on all the four sides. The other two types had fourteen bays with a gabled roofing covering each bay. The intervening valley gutters were supported on wooden planks spread over seven brick pillars erected at intervals along the length of each valley gutter. The effective storage surface in each bay was 21 x 95 sq. ft. The Indian type had brick walls on all the four sides with the roofing made of Mangalore tiles Each shed was provided with ten sliding double doors, four on either side along the length and one in each of the other two sides A covered verandah was provided on the loading side for the entire length. In the case of the Avadi type sheds, the walls and the roofing were made of galvanised iron sheets and the doors were hinged and opened outwards on an open platform.

Among these three types of sheds, the Lahore type was found to be the best. The doors on either end helped proper aeration for all the stacks since it was possible to arrange two rows of stacks with a central gangway in each bay. The semi-circular roofing gave sufficient room for the easy handling of bags in the top layers. In the other two types only four bays out of fourteen had doorways and only one stack could be arranged along the width in each bay. This resulted in insufficient aeration for the stacks in the interior. The handling of bags in the top layers was also difficult because of the tie beam of the gabled roof.

All these sheds were provided with a network of railway lines on one side and metalled roads on the other side running along the length of each shed. This facilitated the despatch of grains by road and rail.

The arrangement of the stacks inside the godowns was designed so as to give sufficient alleyways around each stack. In the Lahore sheds each bay had two rows of four stacks, 14 x 20¼ sq. ft. in area, with a gangway of 3 ft. between the two rows, 2½ feet on either side along the bay margins, 2 ft. between two stacks in the same row and 6 ft. clear space in front and back immediately behind the doorways. The stacking was done to a height of twelve tiers. The bags were arranged brickwise. The base of the stack was made a little broader than the top to ensure stability. Each stack consisted of 6 rows of 5 x 10 alternating with 6 rows of 7 x 8 bags with an additional 4 bags on the top to make 640 bags. In the case of the Indian and Avadi types each bay had four stacks of 17 x 19 sq. ft area with a margin of 3 ft. on one side and one foot on the other side along the bay margins, 3 ft. between two stacks and 6 ft. clear space on either ends. Each stack consisted of 6 rows of 6 x 10 ft. alternating with 6 rows 8 x 8 ft with 6 additional bags on the top to make 750.

The disinfestation of stacks was done with gammexane D 034 containing 4% deodrised benzine hexachloride with 0·5% of active gammexane. The dosage used as 8 ounces for 100 sq. ft. of surface area with 10% extra allowance for the space between bags The first application of the dust was commenced on the 23rd March and continued as the maize stocks were received in the several godowns and was completed by the 16th May 1948. Six cyanogas foot pumps were used in this dusting. A uniform coverage of the dust was obtained by holding the delivery end of the pump, at an angle two feet away from the stack

During the operation, the workers covered their mouths and nostrils with kercheifs. Twentyfive pounds of gammexane could be applied with each pump in a day or eight hours providing sufficient intervals for the workmen The entire stock of maize 3,10,677 bags (26,033 tons) were dusted with 2,060 lbs of gammexane.

The foot pumps were subsequently replaced with rotary pattern dusters, (Root crank dusters model C–3, A) during the second application of the dust. The duster could be operated by one man and it was possible to cover 800–1,000 tons a day using 100. lbs of gammexane. An extra man was provided to relieve him at intervals. The disinfestation work was commenced on 14th June and completed

by the 27 th. in all the godowns. The stocks ear-marked for immediate despatch were not treated 2,87,050 bags (about 23,921 tons) were treated with 1,944. lbsof gammexane in all the nine godowns

The third and final dusting was done in the last week of July and the application of dust was confined to 70,180 bags (5,848 tons) which were likely to remain in storage till the end of August. 471.lbs of gammexane were used for disinfestation. A powder duster known as"Tornado marvel" worked by a "Villiers" 4-stroke air-cooled engine run on petrol was tried in these godowns The machine was mounted on a chassis and fitted with pneumatic tyre wheels and pram handle and could be easily moved between stacks along the alleyways and gangways. It was possible to cover the four sides of the stack with this duster. The top surface required an extended hose. The rate of dusting with this machine was calculated as about 500 tons a day using 500 lbs of gammexane.

Disinfestation of empty godowns was done side by side with stack disinfestation as and when the godowns become empty after the releases. The dosage used was 8 ounces of gammexane for 100 sq ft. of surface. This was commenced in the first week of July and continued till the end of August. 868 lbs. of gammexane were used in all the nine maize godowns.

The approximate cost of disinfestation worked out to 1 anna 3 pies per ton for a single application. At the Avadi godowns 5,443 lbs. of gammexane were used for the three applications and for disinfesting empty godowns. The cost spread over for the entire quantity of maize stored works out Rs. 0 — 2 — 8 per ton.

The stocks were examined at the time of receipt at the harbour and once a month in the godowns in May, June and July 1948 to note the insect population and percentage of tunnelled grains. Samples were drawn with a sampling pin 8 inches long from 3% of the bags selected at random in each stack collecting a handful of grains from each bag. The insect population in the sample was noted and was reduced to one pound. The collected maize was then spread out and about 1,000 grains were sampled out to note the percentage of tunnelled grains. Observations were recorded for each stack and the average insect population and percentage of tunnelled grains of a consignment were worked out. 716 samples were examined from May to July. Further examinations were discontinued from August as the stocks were despatched from the godowns. The result of examination are given in a separate statement.

The population counts showed the presence of the rice weevil (*Sitophilus oryzae*) and the flour beetle (*Tribolium castaneum*) in all the consignments at the time of their receipt in the Madras Harbour. The number of weevils (*Sitophilus oryzae*) did not increase to any appreciable extent during the first examination of the stocks in the godowns in May. Their number was definitely low in the June observations and in July live insects were absent in several godowns. This was mainly due to disinfestation with gammexane D. 034 which reduced the weevil population to a great extent. The first application of the dust in March – April resulted in a large number of dead insects along the stack margins and on the bags. These were brushed and cleanly swept before the second application. The activity of weevils beyond this period was considerably reduced and the insect population in subsequent counts consisted largely of the flour beetles. The effect of gammexane on these beetles was comparatively less. The percentage of tunnelled grain showed considerable variation and inconsistency in the different readings.

The maize stocks remained in storage for over five months 26, 033 tons of maize were received from the middle of March to the end of April and 25, 788 tons were despatched to several districts of the province from May to September. 26½ tons of maize were separated as damaged stocks due to leakages in some of the godowns during rains. About 12 tons out of this quantity were auctioned as starch and the rest disposed off as manure. Thus the over-all shortage for the entire stock of maize was 218½ tons for 26, 033 tons handled or 0·84%. The grains at the time of receipt were weighed at the Madras Harbour after a long voyage and must have weighed more. These were standardised at Avadi in the hot months from April to July when the grains must have weighed less. Therefore the shortage of 218½ tons might be mainly due to the fluctuations in the weight of the grains on account of climatic conditions. It could be claimed that this loss in storage was negligible.

Previous experience of maize storage at Madras had shown that the weevils (*Stophilus oryzae*) infesting the grains multiplied very rapidly. In the case of maize stocks received in December and January the weevils were seen to be swarming in all the godowns by the end of February and their population multiplied 10 to 12 time by the end of May 1948. The low insect population at Avadi and the complete control of weevils were the results of adopting timely preventive measures.

STATEMENT SHOWING THE DEGREE OF INFESTATION IN DIFFERENT MONTHS.

Name of the Consignment	Date of receipt into the Harbour	Examination at the Madras Harbour						Examination in the Avadi godowns during May, June and July 1948. May 1948.						June 1948.						July 1948.					
		Numbers of samples examined	Setaphilus alive	Silophilus dead	Tribolium alive	Tribolium dead	Percentage of tunnelled grains	Number of samples examined	Sitopilus alive	Sitopilus dead	Tribolium alive	Tribolium dead	Percentage of tunnelled grains	Number of samples examined	Sitopilus alive	Sitopilus dead	Tribolium alive	Tribolium dead	Percentage of tunnelled grains	Number of samples examined	Sitopilus alive	Sitopilus dead	Tribolium alive	Tribolium dead	Percentage of tunnelled grains
1. Ciclope ...	14/3	18	5	1	3	...	4·7	13	1	1	15	7	13·9	22	...	1	7	17	7·2	7	...	2	4	9	5·7
2. John Owen ...	21/3	19	1	2	2	2	3·5	39	3	...	5	6	6·3	34	...	2	8	7	6·7	113	...	·1	6	5	7·7
3. Castlebianco ...	27/3	15	1	...	3	...	10·4	103	1	1	16	17	15·2	69	...	1	8	19	9·2	7	5	3	33	18	11·4
4. Patagonia Victory	1/4	11	1	1	3	...	12·5	67	1	2	17	13	16·2	32	...	1	7	19	7·0	...	...	...	...	...	...
5. Rajput ...	28/3	2	7	8	2	2	4·5	51	2	7	17	17	13·1	42	7	6	8	25	13·5	28	9	4	32	16	10·4
6. Shahzada ...	7/4	4	1	...	7	3	9·8	6	...	4	15	14	17·2	3	...	1	5	15	6·4	...	...	...	...	...	...
7. Tonjor ...	9/4	4	1	...	4	6	3·7	29	..	3	13	16	13·6	7	...	3	7	19	4·4	...	...	...	...	...	...
8. Havildar ...	27/4	5	...	...	4	...	5 1	...	...	...	...	...	...	44	1	6	25	16	15·2	...	...	...	...	...	...

A Soil Survey for Fruit Development in the Ceded Districts (Contd.)*

By

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APPENDIX II.

Results of mechanical analysis (Results expressed on moisture free basis)

Area	Pit No.	Depth	No. of samples	Moisture %	Clay %	Silt %	Fine sand %	Coarse sand %	Fine Fractions (clay silt)	Coarse Fractions (F. sand C. sand.)
1	2	3	4	5	6	7	8	9	10	11
Kottur	2	0'—1'	4	4·21	33·2	5·2	21·2	40·7	38·4	61·9
	,,	1'—2'	5	5·80	49·8	10·5	22·5	17·9	60·3	40·4
	,,	2'—3'	6	5·58	37·7	18·2	22·1	21·6	55·9	43·7
	,,	3'—4'	7	4·38	37·6	6·8	16·3	39·2	44·4	55·5
	,,	4'—5'	8	6·53	43·6	11·2	10·1	31·2	54·8	41·3
	4	0'—1'	16	3·98	44·8	6·7	16·5	30·2	51·5	46·7
	,,	1'—2'	17	4·27	47·8	5·2	13·2	33·2	53·0	46·4
	,,	2'—3'	18	4·57	51·6	4·4	13·7	29·2	56·0	42·9
	,,	3'—4'	19	4·74	51·4	7·7	11·8	28·5	59·1	40·3
	,,	4'—5'	20	4·59	49·5	7·4	12·0	30·3	56·9	42·3
	,,	5'—6'	21	4·69	48·8	8·9	12·5	29·6	57·7	42·1
	,,	6'—7.	22	4·54	39·8	6·0	13·8	39·2	45·8	53·0
	7	0"—9"	31	1·32	16·2	4·1	35·8	44·8	20·3	80·6
	,,	9"—18"	32	0·83	11·9	2·5	19·6	67·1	14·4	86·7
	,,	18"—30"	33	1·32	17·5	3·5	24·3	56·2	21·0	80·5
	,,	30"—40"	34	1·76	20·1	4·6	16·6	59·5	24·7	76·1
	,,	40"—41"	35	2·88	29·3	6·0	15·3	50·1	35·3	65·4
	,,	4'—5'	36	2·02	23·0	5·1	18·0	54·8	28·1	72·8
	,,	5'—6'	37	5·44	51·9	7·6	12·8	28·7	59·3	41·5
	9	0'—1'	40	2·86	37·6	4·4	19·7	39·0	42·0	58·7
	,,	1'—2'	41	3·17	38·2	7·0	19·7	36·0	45·2	55·7
	,,	2'—3'	42	3·17	39·0	6·2	18·2	37·6	45·2	55·8
	10	0'—1'	43	1·75	23·9	3·6	16·7	56·6	27·5	73·3
	,,	1'—2'	44	2·65	35·4	5·4	13·8	46·8	40·8	60·6
	,,	2'—3'	45	3·46	48·8	6·1	12·7	32·8	54·9	45·5
Rudravaram	18	0'—1'	72	4·91	53·1	17·1	15·7	14·8	70·2	30·5
	,,	1'—2'	73	4·96	56·3	19·7	13·1	12·0	76·0	25·1
	,,	2'—3'	74	4·99	56·8	16·9	13·4	13·9	73·7	27·3
	,,	3'—4'	75	5·14	55·1	14·0	11·5	20·7	69·1	32·2
	,,	4'—5'	76	5·34	55·5	13·8	12·0	20·2	69·3	32·2
	20	0'—1'	82	0·44	7·0	1·8	45·3	46·7	8·8	92·0
	,,	1'—2'	83	0·53	9·6	1·7	43·1	46·6	11·3	89·7

* Continued from Vol. XXXVI, No. 5, P. 234.

APPENDIX II—Contd.

Area	Pit No.	Depth	No. of samples	Moisture %	Clay %	Silt %	Fine sand %	Coarse sand %	Fine Frections (clay silt)	Coarse Fractions (F. sand C. sand)
1	2	3	4	5	6	7	8	9	10	11
	,,	2'—3'	84	1·36	17·5	7·1	36·3	39·8	24·6	76·1
	,,	3'—4'	85	1·77	24·4	10·0	28·3	38·3	34·4	66·6
	22	0'—1'	91	8·57	16·1	11·4	29·6	43·0	28·2	72·6
	,,	1'—2'	92	2·87	30·9	19·3	16·4	33·5	50·2	49·9
	,,	2'—3'	93	3·75	39·7	18·0	18·6	20·0	57·7	38·6
	,,	3'—4'	94	4·76	47·5	14·2	16·7	19·2	61·7	35·9
	,,	4'—5'	95	5·12	46·0	17·1	15·2	21·5	63·1	36·7
	24	0'—1'	101	4·13	35·7	20·6	32·8	10·7	56·3	43·5
	,,	1'—2'	102	4·40	39·2	70·4	29·2	9·7	59·6	38·9
	,,	2'—3'	103	4·46	41·6	23·6	27·3	7·8	65·2	35·1
	,,	3'—4'	104	4·76	46·7	23·6	26·3	1·9	70·3	28·2
	,,	4'—5'	105	4·82	44·4	23·4	7·5	4·1	67·8	31·6
	25	0'—1'	106	1·30	13·7	5·0	63·8	17·5	18·7	81·3
	,,	1'--2'	107	1·37	14·2	4·1	77·6	3·7	18·3	81·3
	.	2'—3'	108	1·29	13·7	4·5	75·5	6·8	18·2	82·3
	,,	3'--4'	109	0·84	8·8	2·8	73·6	15·4	11·6	89·0
	,,	4'—5'	110	1·07	12·1	2·3	62·3	24·2	14·4	86 5
	27	0'—1'	115	3·72	38·7	10·9	22·6	26·4	49·6	49·0
	,,	1'--2'	116	3·57	34·5	8·3	35·4	20·6	42·8	56·0
	,,	2'—3'	117	4·70	41·7	15·7	27·1	14·0	57·4	41·1
	,,	3'—4'	118	5·13	46·1	13·7	23·4	15·5	59·8	38·9
	,,	4'—5'	119	5·00	30·5	14·5	34·1	20·7	45·0	54·8
	,,	5'—6'	120	3·59	47·8	13 2	24·1	18·5	56·0	42·6
	,,	6'—7'	121	4·53	41·1	16·2	22·9	18·5	57·3	41·4
	,,	7'- 8'	122	3·66	34·4	11·7	22·7	29·8	46·1	52·5
	31	0'—1'	142	3·76	32·6	14·1	22·5	29·7	46·7	52·2
	,,	1'—2'	143	4·90	42·3	11·9	15·9	30·0	54·2	45·9
	,,	2'—3'	144	5·54	36·5	7·4	22·5	33·5	43·9	56·0
	,,	3'—4'	145	5·01	41·3	5·8	7 3	44 2	47·6	51·5
Giddalore	34	0'—1'	155	4·68	38·6	19·6	22·6	16·0	58·2	38·6
	,,	1'—2'	156	5·06	42·1	20·0	22·0	12·6	62·1	34·6
	,,	2'—3'	157	5·43	44·4	23·3	20·3	8·5	67·7	28·8
	,,	3'—4'	158	5·67	43·8	25·4	20·6	6·9	69·2	27·5
	,,	4'—5'	159	5·75	42·2	21·5	18·0	11·2	63·7	29·2
	,,	5'- 5'	160	5·41	42·5	19·3	19·9	14·3	61·8	34·2
	37	0'—1'	173	1·85	18·1	6·4	39·7	36·0	24·5	75·7
	,,	1'—2'	174	4·18	37·8	15·6	30·1	14·7	53·4	44·8
	,,	2'—3'	175	4·15	38·3	18·8	27·9	13·8	57·1	41·7
	,,	3'—4'	176	4·23	38·1	18·0	27·9	15·0	56·1	42·9
	,,	4'—5'	177	3·91	33·3	19·5	28·7	18·0	52·8	46·7
	,,	5'—6	178	3·73	31·9	16·9	29·7	19·5	48·8	49·2
	,,	6'—7	179	3·07	26·8	14·2	25·7	32·4	41·0	57·6

APPENDIX II—Contd.

Area	Pit No.	Depth	No. of samples	Moisture %	Clay %	Silt %	Fine sand %	Coarse sand %	Fine Fractions (clay silt)	Coarse Fractions (F. sand C. sand)
1	2	3	4	5	6	7	8	9	10	11
	39	0'—1'	185	2·32	20·5	7·4	35·2	35·6	27 9	70·8
	,,	1'—2'	186	2·77	23·7	10·8	26·6	35·7	34·5	62·3
	,,	2'—3'	187	2·67	28·3	11·6	33·1	25·4	39·9	58·5
	,,	3'—4'	188	2·73	27·5	13·1	31·3	27·9	40·6	59·2
	,,	4'—5'	189	2·90	34·5	16·8	27·5	20·7	51·3	48·2
	,,	5'—6'	190	3·09	31·7	10·3	33·4	24·4	42·0	57 8
	,,	6'—7'	191	3·04	25·8	13·9	27·0	25·6	39·7	52·6
	,,	7'—8'	192	2·92	26·3	12·0	31·4	27·3	38·3	58·7
	40	0'—1'	193	3·60	34·5	16·8	27·5	19·7	51·3	47·2
	,,	1'—2'	194	3·71	31·2	14·0	34·9	18·5	49·2	53·4
	,,	2'—3'	195	3·23	23·5	29·5	41·8	6·6	53·0	48·4
	,,	3'—4'	196	2·18	22·5	13·8	43·5	19·0	36·3	62·5
	,,	4'—5'	197	4·39	40·0	14·9	23·2	19·4	54·9	42·6
	,,	5'—6'	198	2·49	23·6	12·1	43·2	20·9	35·7	64·1
	42	0'—1	207	3·61	38·4	18·2	36·2	8·5	56·6	44·7
	,,	1'—2'	208	3·76	38·2	18·5	38·2	6·0	56·7	44·2
	,,	2'—3'	209	3·50	37·3	17·6	36·9	7·6	54·9	44·5
	,,	3'—4'	210	2·78	30·9	10·7	30·4	29·7	41·6	60·1
	,,	4'—5'	211	3·64	37·6	13·8	27·0	20·6	51·4	47·6
	44	0'—1'	217	2·84	19 3	26·2	30 3	20·2	45·5	50·5
	,,	1'—2'	218	2·07	16·6	18·2	28·1	35·3	34·8	63·4
	,,	2'—3'	219	1·78	17·8	8·6	41·0	30·9	26·4	71·9
	,,	3'—4'	220	1·93	12·2	5·6	29·8	53·7	17·8	83·5
Vontimitta	48	0'—1'	231	2·04	21·4	11·8	39·3	25·8	33·2	65·1
	,,	1'—2'	232	2·54	26·7	11·5	33·5	28·1	38·2	61·6
	,,	2'—3'	233	4·09	45·6	12·0	17·7	25·2	57·6	42·9
	,,	3'—4'	234	4·84	53·6	14·2	16·1	17·7	67·8	33·8
	,,	4'—5'	235	4·99	56·4	13·7	16·9	14·4	70·1	31·3
	,,	5'—6'	236	3·30	36·2	19·4	24·7	14·9	55·6	39·6
	49	0'—1'	237	3·02	33·8	22·9	29·5	13·4	56·7	42·9
	,,	1'—2'	238	3·06	32·3	21·1	34·3	13·4	53·4	47·7
	,,	2'—3'	239	3·09	31·0	18·3	34·3	16·6	49·3	50·9
	,,	3'—4'	240	3·96	43·0	19·4	26·9	11·2	62·4	38·1
	,,	4'—5'	241	5·55	58·8	14·3	14·9	11·2	73·1	26·1
	50	0'—1'	243	3·38	35·7	18·6	30·0	12·6	54·3	42·6
	,,	1'—2'	244	4·37	51·8	12·2	15·2	21·6	64·0	36·8
	,,	2'—3'	245	3·48	35·0	16·8	23·3	19·4	51·8	42·7
	,,	3'—4'	246	3·52	35·2	16·9	24·8	17·9	52·1	42·7

APPENDIX II - Contd.

Area	Pit No.	Depth	No. of samples	Moisture %	Clay %	Silt %	Fine sand %	Coarse sand %	Fine Fractions (clay silt)	Coarse Fractions (F. sand C. sand)
1	2	3	4	5	6	7	8	9	10	11
	53	0'—1'	258	1·75	19 1	17·3	42·6	21 5	36 4	64·1
	„	1'—2'	259	3·01	43·8	14·7	22·8	15·2	58 5	38 0
	„	2'—3'	260	3·80	56·4	15·1	14.1	15·9	71·5	30 0
	„	3'—4'	261	3 88	52·3	13·0	13·9	21·7	65·3	35·6
	56	0'—1'	270	2·85	30·1	17·3	31·3	18·5	47·4	49 8
	„	1'—2'	271	3·68	37·1	14·3	28·7	15 6	51·4	44·3
	„	2'—3'	272	4·03	38·8	16 2	27·6	14 4	55·0	42·0
	„	3'—4'	273	3·90	38 5	14·8	25·8	20·0	53·0	45·8
	„	4'—5'	274	3·93	33·1	22·3	20·9	22·0	55 6	42·9
	57	0'—1'	275	2·10	24·7	11·1	39·3	24·9	35 8	64·2
	„	1'—2'	276	1·66	21·1	10 4	52·5	17 0	31·5	69 5
	„	2'—3'	277	2·06	25·3	10·4	36·4	28·8	35·7	65·2
	„	3'—4'	278	1·90	19·6	10·7	36·6	34·1	30·3	70·7
	„	4'—5'	279	1·96	20·7	9·9	40·0	29 9	30·6	69 9
	60	0'—1'	290	3·44	28·2	7·8	26·0	31·4	36·0	57·4
	„	1'—2'	291	3 68	29 9	7·0	25·1	29 7	36 9	54·8
	„	2'—3'	292	3·85	30 7	8·6	21·7	31·4	39·3	53·1
	„	3'—4'	293	3·66	32·0	7·7	19·3	32·1	39 /	51·4
Kodur	64	0'—1'	310	1·82	21·1	13·5	58·8	7·6	34 6	66·4
	„	1'—2'	311	2·12	29·4	12·5	58·3	5·5	41·9	58·8
	„	2'—3'	312	2·91	35·5	13·1	47·9	4·6	48 6	52·5
	„	3'—4'	313	3·08	38·7	13·7	44·2	4·1	52·4	48·3
	„	4'—5'	314	2·98	36·7	15 5	44·9	4·6	52·2	49·5
	„	5'—6'	315	3·06	37·2	14·2	43·5	5·6	51·4	49·1
	„	6'—7'	316	3·15	35·1	11·4	36·1	16·9	46·5	53 0
	„	7'—8'	317	3·29	32·3	11·6	44 4	9·6	43·9	54·0
	66	0'—1'	324	2·14	30·7	11·7	50·4	8·7	42·4	59·1
	„	1'—2'	325	3·01	37·2	13·4	42·2	7·6	50·6	49·8
	„	2'—3'	326	3·12	37·7	13·4	41·9	6 9	51·1	48 8
	„	3'—4'	327	3·41	38·8	13·0	39·3	9·1	51·8	48·4
	„	4'—5'	328	3·41	41·4	13·7	37·1	7·3	55 1	44 4
	„	5'—6'	329	3·40	41·4	14·5	37·5	6·6	57 2	44 0
	„	6'—7'	330	3·26	42·2	15·0	39·0	5·0	57·2	44 0
	„	7'—8'	331	3·10	40 3	15·5	41·2	4·8	55 8	46·0
	68	0'—1'	340	1·80	26·0	8·9	43·0	22 1	34 9	65·1
	„	1'—2'	341	3·35	49·7	14·2	26·7	10·0	63·9	36·7
	„	2'—3'	342	2·81	45·8	12·6	30·2	13·4	58·4	43·6
	„	3'—4'	343	3 62	49 6	12·9	23·3	14·5	62·5	37·8
	„	4'—5'	344	3·56	50·0	10 9	21·8	18·7	60·9	40 5
	„	5'—6'	345	3·55	49·0	14·3	21·6	16·0	63·3	37·6
	„	7'—8'	347	3·43	47·7	11·9	22·0	19·6	59·6	41 6

APPENDIX II—Contd.

Area	Pit No.	Depth	No. of samples	Moisture %	Clay %	Silt %	Fine sand %	Coarse sand %	Fine Fractions (clay silt)	Coarse Fractions (F. sand C sand)
1	2	3	4	5	6	7	8	9	10	11
	70	0'—1'	355	0·45	9·1	5·0	66·0	21·2	14·1	87·2
	,,	1'—2'	356	0·79	13·9	9·3	57·0	20·3	23·2	77·3
	,,	2'—3'	357	1·81	30·6	8·6	45·5	16·5	39·2	62·0
	,,	3'—4'	358	2·35	36·4	9·7	37·6	16·6	16·1	54·2
	,,	4'—5'	359	2·60	41·1	7·9	36·0	16·4	49·0	52·4
	,,	5'—6'	360	2·71	43·2	9·7	29·0	16·6	52·9	45·6
	,,	6'—7'	361	2·22	38·3	8·2	37·4	15·2	46·5	52·6
	,,	7'—8'	362	2·16	33·0	9·9	38·0	20·1	42·9	58·1
	71	0'—1'	363	0·81	13·1	7·8	65·1	13·1	20·9	78·4
	,,	1'—2'	364	1·80	28·3	14·5	47·0	10·6	42·8	57·6
	,,	2'—3'	365	2·46	36·3	16·0	39·1	8·9	52·3	48·0
	,,	3'—4'	366	2·78	38·9	18·2	33·4	9·4	57·1	42·8
	,,	4'—5'	367	2·45	41·3	16·0	31·5	10·6	57·3	42·1
	,,	5'—6'	368	2·88	38·9	19·0	31·9	10·4	57·9	42·3
	,,	6'—7'	369	3·94	49·4	15·6	27·4	9·5	65·0	36·9
	,,	7'—8'	370	3·55	46·7	19·1	26·9	8·9	65·8	35·8
	75	0'—1'	386	1·53	24·6	11·7	54·3	7·9	36·3	62·2
	,,	1'—2'	387	1·95	29·3	15·3	48·0	7·4	44·6	55·4
	,,	2'—3'	388	2·73	38·0	14·7	34·7	13·1	52·7	47·8
	,,	3'—4'	389	3·29	39·5	16·0	27·0	18·3	55·5	45·3
	78	0'—1'	403	0·95	15·2	5·8	71·6	7·3	21·0	78·9
	,,	1'—2'	404	1·46	1·46	9·4	63·6	6·4	31·2	70·0
	,,	2'—3'	405	1·61	1·61	9·8	60·7	5·7	34·3	66·4
	,,	3'—4'	406	1·74	1·74	8·6	59·9	5·6	35·6	65·5
	,,	4'—5'	407	2·21	2·21	7·7	55·3	4·6	39·9	59·9
	,,	5'—6'	408	2·03	2·03	10·4	56·9	4·4	38·8	61·3
	,,	6'—7'	409	2·18	2·18	11·2	56·1	4·4	39·6	60·5
	,,	7'—8'	410	2·56	2·56	10·0	52·7	3·8	43·9	56·5
Panyam	79	0'—1'	411	0·89	3·0	6·6	12·1	75·5	9·6	87·6
	,,	1'—2'	412	2·22	17·0	7·3	19·2	53·6	24·3	72·8
	,,	2'—3'	413	1·98	15·8	7·4	15·4	61·2	23·2	76·6
	,,	3'—4'	414	1·83	16·0	7·1	13·9	63·8	23·1	77·7
	,,	4'—5'	415	1·71	13·7	6·2	12·7	67·2	19·9	79·9
	,,	5'—6'	416	2·32	17·7	11·2	18·2	52·1	28·9	70·3
	,,	6'—7'	417	2·53	18·5	10·2	27·2	40·8	28·7	68·0
	,,	7'—8'	418	0·90	7·8	2·5	2·2	87·5	10·3	89·7
	80	0'—1'	419	3·92	30·7	12·7	16·0	34·1	43·4	50·1
	,,	1'—2'	420	4·63	35·7	13·4	14·4	32·7	49·1	47·1
	,,	2'—3'	421	5·12	38·7	11·4	13·7	30·0	50·1	43·7
	,,	3'—4'	422	5·99	46·0	16·5	14·7	16·8	62·5	31·5
	,,	4'—5'	423	5·60	44·5	17·5	17·1	12·5	62·0	29·6
	,,	5'—6'	424	4·91	34·4	21·1	17·7	13·9	55·5	31·6
	,,	6'—7'	425	3·98	26·6	15·3	19·7	25·0	41·9	44·7
	,,	7'—8'	426	3·15	24·3	9·8	15·6	38·9	34·1	54·5

APPENDIX III

Results of analysis of 35 selected surface samples of soils.

No. of samples	Locality	Loses on Ignition	Nitrogen	Lime (Gao)	Total Potash K_2O	Total phosphoric acid P_2O5	Available potash K_2O	Available Phoricacid P_2O5	PH
4	Kottur	2·63	·042	0·52	0·31	·005	·008	Trace	7·41
9	,,	4·22	·051	0·41	0·42	·002	·011	,,	7 05
16	,,	4·96	·056	1·05	0·59	·002	·025	,,	8·06
31	,,	1·42	·029	0 34	0·24	·002	·011	,,	7 61
40	,,	3·87	·048	0·27	0·46	·002	·006	,,	6·72
43	,,	2·77	·034	0·22	0·31	·001	·017	,,	6·77
72	Rudravaram	5·34	·044	0·63	1·26	·006	·009	,,	7·71
82	,,	0·65	·018	0·08	0·16	·002	·015	,,	7·18
91	,,	1·70	·028	0·18	0·26	Trace	·011	,,	7·70
101	,,	2·96	·025	0·53	0·81	,,	·014	,,	8·29
106	,,	1·20	·012	0·36	0·34	,,	·018	,,	8·48
111	,,	6·17	·022	4·29	0·71	,,	·008	,,	8·58
142	,,	4·86	·007	0·61	0·85	,,	·014	,,	8·73
155	Giddalore	3·20	·036	4·25	1·19	,,	·023	,,	8·55
173	,,	1·49	·041	0 24	0·63	,,	·017	,,	8·57
185	,,	1·86	·023	1·67	0·63	,,	·008	,,	8·76
193	,,	3·09	·015	4·49	1·27	,,	·012	,,	8·92
207	,,	29·7	·025	0·38	0·99	·004	·008	,,	8 47
217	,,	4·55	·022	6·06	1·09	·009	·015	·001	8·85
231	Vontimitta	3·45	·064	1·07	1·38	·144	·034	·104	8 57
237	,,	4·79	·108	1·91	1·91	·078	·039	·043	8·74
242	,,	4·18	·041	4·07	1·69	·005	·015	Trace	8·82
258	,,	3·75	·055	2·60	1·51	·075	·027	·031	88·7
270	,,	3·91	·056	3·24	1·85	·146	·030	·099	8·81
275	,,	2·59	·031	1·50	1·05	·028	·024	·015	8 71
290	,,	2·90	·084	4·17	0·87	·051	·028	·017	8·64
310	Kodur	1·78	·064	1·26	0·46	·017	·026	·013	8.66
324	,,	2·19	·034	0 19	0·57	·002	·019	Trace	7·90
340	,,	2·75	·032	0·11	0·54	·002	·019	,,	7·24
355	,,	0·61	·016	0·10	0·22	·002	·015	,,	8 16
363	,,	1·29	·028	0·11	0·35	·003	·015	,,	7·95
386	,,	2·69	·048	0·17	0·61	·011	·019	,,	7 64
403	,,	1·33	·029	0·12	0 52	·002	·025	,,	8·48
411	Panyam	0·95	·012	1·43	0·35	·022	·010	·010	8·48
419	,,	4·27	·115	3·71	0·98	·548	·035	·329	8·63

APPENDIX IV

Results of analysis of water samples (Results expressed in parts per 100,000) and depth of water table in feet in summer and rainy season

Area	Kottur—Ujjini						Rudravaram—Sirvel			
Serial No.	1	2.	3.	4.	5.	6.	7.	8.	9.	10.
Particulars	Maruru Vanka	Kottur Tank	Step well Harkanahalu near pit No. 16	Step well Kalapuram near pit No. 11	Draw well Ujjini near pit No. 14	Draw well Ujjini near pit No 15	Okkileru-vagu.	Well in Ibra-him's Chini garden	Nagireddi-palli. Chintalabhavi	Rudravaram well in Chini garden
Total solids at 405°C	15·1	45·0	67·8	109·2	153·4	87·4	24·8	24·6	23·4	33·4
Calculated salts:										
Calcium bicarbonate	8·1	15·4	25·1	19·4	33·2	29·2	16·2	17·0	19·4	12·1
Magnesium ,,	4·5	8·5	18·6	29·6	38·7	20·4	7·2	2·2	6·9	7·4
Sodium ,,	3·2	2·9	19·6	31·5	...	...	1·9	...	0·5	15·8
Calcium carbonite	...	...	...	...	...	...	...	...	...	...
Magnesium ,,	...	...	...	...	...	...	...	...	...	...
Sodium ,,	...	...	...	...	...	...	...	...	...	..
Calcium sulphate	...	...	...	...	...	...	...	...	...	...
Magnesium ,,	...	...	...	...	4·3	3·2	...	...	...	...
Sodium ,,	1·5	4·5	2·7	6·1	6·7	4·3	2·2	1·0	1·1	1·8
Calcium Chloride	...	...	...	...	...	...	...	...	...	...
Magnesium ,,	...	...	...	...	...	...	...	...	...	...
Sodium ,,	3·5	23.5	15·3	29·4	92·8	37·6	7·0	4·7	3·5	5·9
Depth of water in summer	...	...	50	50	60	55	...	15	15	15
Depth of water table in rainy season.	...	...	45	40	50	50	...	...	7	7

APPENDIX IV—Contd.

Area	Rudravaram—Sirvel			Diguvameta						
Serial No.	11	12	13	14	15	16	17	18	19	20
Paticulars	Rudravaram well in Chinna Ramayya's Mango garden.	Well in Mango tope near pit No. 26	Rudravaram well in Reddy's tope	Negireddipalli Draw well	Kanchipalli step well	Kanchipalli step well	Giddalorepalli Bhavi-step well	Giddalore Virannabhavi	Krishnnan Satiy palli draw step well	Krishnan setty palli draw well of choultry
Total solids at 105°C	32·0	48·4	51·6	12·4	33·2	37·6	73·5	74 8	192·3	98·6
Calculated salts:										
Calcium Bicarbonate	16·2	25·1	6·5	9·7	12·1	7·3	24·3	25·9	5·7	4.9
Magnesium ,,	14·8	6·6	5·0	2·9	15·1	9·3	...	12·0	10·9	7·9
Sodium ,,	6·5	...	42·9	...	2·0	20·4	...	...	104·2	64·9
Colcium carbonate	...	...	...	...	...	...	40	...	..	:
Magnesium ,,	...	...	...	...	.	...	...	5·9	...	...
Sodium ,,	...	...	...	...	6·4	6·4	...	...	42·4	24·3
Calcium sulpate	...	...	...	...	...	...	6·0	...	...	...
Mangnesium	...	3·7	...	1·1	...	...	...	3·0	...	...
Sodium ,,	1·1	3·5	0·6	..	...	...	...	0·7	1·3	3 5
Calcium Chloride	...	...	...	...	...	...	1·2	...	...	...
Magnesium ,,	...	...	...	...	...	...	16·9	...	..	...
Sodium ,,	3·5	21·2	14·1	...	4·7	5·3	9·6	21·1	61·4	12·9
Depth of water table in summer (ft)	15	20	15	...	35	40	50	60	45	40
Depth of water table in rainy season	6	10	6	...	25	30	45	40	30	35

APPENDIX IV—Contd.

Area	Giddalore					Vontimitta				
Serial No.	21	22	23	24	25	26	27	28	29	30
Particulars	Modarupallimora saguranna step well	Giddalore Mission school draw well	Krishnam setty village well	Giddalore taluk office draw well	Giddalore river Sagileru	Pachapalli near Pit No. 51	Salabad near Pit No 52	Mangampet near Pit No. 56	Polubuchayya galipalli Venka near Pit No. 53	Nadimpalli near pit No. 54
Total solids at 105°C	46·8	71·2	120·6	59·1	20·7	43·0	40·0	48·0	19·0	42 0
Calculated salts:										
Calcium bicarbonate	11·7	16·6	8·1	29·1	10·5	23·5	24·3	31·6	11·3	26·7
Magnesium ,,	11·4	24·5	25·5	5·9	8·1	22·3	19·0	21·2	0·9	24·4
Sodium ,,	...	...	37·9	...	...	...	...	...	0·7	24·4
Calcium Carbonate	...	...	...	...	...	...	...	...	...	...
Magnesium ,,	1·7	2·9	..	4·2	1·3	...	...	...	...	...
Sodium ,,	...	4·8	...	17·0	0·4	...	...	...	...	...
Calcium sulphate	...	...	...	...	...	...	...	...	...	...
Magnesim ,,	...	..	...	2·5	...	...	0·4	2·5	...	1·4
Sodium ,,	...	2·4	8 1	...	0·9	3·4	3·1	...	...	...
Calcium Chloride	...	...	..	...	..	...	...	...	...	...
Magnesium ,,	2·2	...	...	9·0	...	...	...	1·3	...	0·3
Sodium ,,	25·9	25·7	35·7	7·7	4·1	7·0	5·9	6·0	2·9	4 3
Depth of water table in summer	50	55	50	55	...	20	30	30	...	15
Depth of water table in rainy season	40	40	35	45	...	15	20	20	15	3

APPENDIX IV—Contd.

Area	Vontimitta							Kodur			
Serial No.	31	32	33	34	35	36	37	38	39	40	41
Particulars	Cherlopalli near pit No. 55	Chelam Reddi's natural garden near pit No. 57	Chellama Reddy's made up garden near pit No. 59	Mantapampalli waste land near Pil No. 61	Vontimitta out skrists	Vontimitta town	Vontimitta tank water	Mallapalli Kondayya's garden	Rachapalli Obili Reddi's garden	Balli Reddipalli Iswara Reddy's garden	Satram Rapupalli Sitaramayya's garden
Total solids at 105°C	27·0	33·0	44·0	22·0	63·0	68·0	11·0	27·0	50·0	60·0	38·0
Calculated salts :											
Calcium Bicarbonate	13.8	25·1	21·1	15·4	30·0	59·1	5·7	11·1	28·3	34·8	19·4
Magnesium ,,	12·2	13·9	18·3	10·3	0.7	...	5·1	17·1	26·3	22·7	23·4
Sodium ,,	7·0	...	...	2·5	...	...	...	0·6	0 6	...	...
Calcium Carbonate	...	...	...	...	...	...	...	...	...	...	...
Magnesium ,,	...	...	...	...	...	...	...	...	...	...	...
Sodium ,,	...	...	...	...	...	...	...	...	...	...	...
Calcium Sulphate	...	...	...	...	..	93·1	...	...	...	...	...
Magnesium ,,	...	1·8	2·1	...	6·3	25·0	...	...	4·1	2·5	0·4
Sodium ,,	1·0	...	...	0·7	...	...	...	0·8	...	...	...
Calcium Chloride	...	...	...	...	...	...	...	...	...	...	...
Magnesium ,,	...	0·3	1·1	...	7·6	61·0	0·6	...	1·0	6·0	1·4
Sodium ,,	4·1	5·5	6·2	2·9	7·6	87·5	0·7	2·3	9·9	10·8	3·6
Depth of water table in summer (ft)	15	20	20	15	30	35	...	40	40	30	40
Depth of water table in rainy season	3	10	10	4	20	25	...	30	30	20	25

APPENDIX IV—Contd.

Area	Kodur								Panyam	
Serial No.	42 43	44	45	45	46	47	48	49	50	51
Particulars	Reddivaipalli Mannuri Sitaramaya's garden	Well of Rami Reddi Kondayya & Co. of Kichamma Agraharam	Chiyyavaram Venkata Reddi's garden	Tirupatiyeru	Anantarajupeta Sivarami Reddi's garden	Anantaraju petta Anavama	Sattigunta Sambasivan's	Janakipuram Lakamma's garden	Panyam tank	Panyam draw well
Total Solids at 105°C	41·0	55·0	26·0	10·0	29·0	49·0	14·0	20·0	19·0	38·0
Calculated salts:										
Calcium Bicarbonate	21·9	25·9	19·4	4·9	21·1	20·2	6·5	13·8	12·1	31·6
Magnesium ,,	18·3	25·6	9·9	2·9	14·3	30·5	0·7	3·7	7·1	8·8
Sodium ,,	...	...	...	...	...	1·5	...	...	5·3	...
Calcium carbonate	...	...	...	...	...	...	...	...	...	...
Magnesium ,,	...	...	...	...	...	...	...	...	...	...
Sodium ,,	...	...	...	...	...	...	...	...	...	...
Calcium sulphate	...	...	...	...	...	...	...	...	...	...
Magnesium ,,	2·4	2·5	0·3	1·3	1·0	...	0·5	0·3	...	...
Sodium ,,	...	...	...	...	...	6·8	...	...	0·6	3·5
Calcium chloride	...	...	...	...	...	...	...	...	...	...
Magnesium ,,	1·3	3·9	0·2	0·1	...	...	0·8	3·0	...	...
Sodium ,,	5·4	7·5	3·2	1·7	4·1	13·7	5·4	1·6	4·1	1·0
Depth of water table in summer (ft)	30	25	25	30	25	25	25	25	...	45
Depth of water table in rainy season	15	15	15	15	10	10	10	10	0	35

*Selected Article**

Agricultural Research : A Review

By

R. L. SETHI and I. B. CHATTERJEE

The Indian Council of Agricultural Research has now been in existence for well nigh 20 years. The Royal Commission on Agriculture recognised that the problem of improving agriculture was really the problem of improving the village life and this must be studied as a whole. The council kept this point in view and on the one side it organized widespread ramification of co-ordinated research and on the other it subsidized village project schemes embracing important aspects connected with agriculture and animal husbandry in the villages. These schemes on the one side emphasized the importance of scientific aid to agriculture and on the other were so conducted that they have led to a substantial increase in the income of the cultivator. As a matter of fact wherever these schemes have been tried the neighbouring cultivators have also been enthused to adopt many of the methods.

It is difficult to present in a small compass all the varied activities in which the Council has been engaged since 1929. Only a brief description taken at random of some of the more notable items will be given here just to present an idea of the nature and quality of the work that has been and is being conducted under its aegis.

RICE :

In the field of crop production rice occupies the foremost place. The Council gave great impetus to its improvement by subsidizing a chain of schemes at Berhampore, Cuttack, Chinsur, Nagina, Raipur, Habibganj, Bombay, Madras, Mysore, Kashmir, Travancore and Baroda. The major number of these schemes terminated between 1941 to 1945. As a result of investigations on the breeding side, a large number of varieties have been produced which are suitable for varying conditions, such as high and low-lying areas, suitable for resistance under flood, drought and saline conditions, resistant to the attack of insect pests, diseases and so forth.

In parts of Central Provinces and Bihar the evolution of purple-pigmented varieties has solved the menace of wild rice weed which was indistinguishable. This has led to a saving of about 20 lakhs of maunds of paddy equivalent to at least 60 lakhs of rupees in the Chattisgarh Division alone, whereas the cost of research was about a lakh of rupees.

*From the 'Indian Farming' Vol. No. IX No.11—November 1948.

The percentage increase amongst the important varieties has been 20 to 25 per cent in Bihar, 30 to 52 per cent in Orissa, 17 to 23 per cent in Travancore and 55 to 70 per cent in Kashmir. The results in Bengal and Madras have also been of similar order.

WHEAT:

In wheat the most intriguing problem has been that of rust, which recently devastated a large area in Central India, Centrál Provinces and Berar, Bombay and Hyderabad, etc. during 1946—47. In Central Provinces and Central India the entire crop was lost leaving nothing even for seed purpose and in the former province, the Government had to import 40,000 tons of wheat for distribution as seed. The situation had become so serious that three meetings were called by the Government of India and held at Delhi to consider measures of control and a Wheat Rust Control Committee with the Agricultural Commissioner with the Government of India as a convener was formed. The Indian Council of Agricultural Research also convened a special Wheat Rust Committee in December 1947 in Delhi and again in the Crops and Soils Wing meeting held in April 1948 in Madras.

There are three types of rust, viz. black, red and yellow; each having several physiological races. These physiological races (for each type of rust) cannot be distinguished from their outward morphological characters. Their main difference lies in the power of attacking different varieties and strains of wheat or other cereals and/or plants. The problem here is to evolve by breeding, hybridization, etc. such strains as will be immune or resistant to one or more or, if possible, all of the physiological races. The Council has for the last 18 years (since 1930—31) been subsidizing a comprehensive scheme of research on this highly important work. Although the results have not reached the final stage yet it has been highly instructive. The study on the life-history of the different rusts along with their behaviour on alternate hosts, have thrown much light on their possible role. The work suggests that the persistence of rust from year to year is probably not due to alternate hosts but to the over-summering of the disease on volunteer (i. e. self-sown) crop and early-sown wheat in the hilly areas of Nepal in the North and Nilgiris in the South. The disease from there is carried by wind to the plains where the standing crop is infected resulting in bad years, the complete destruction of the entire crop. In normal years the loss may be about five per cent involving about six crores of rupees in both Indian Dominion and Pakistan. The ameliorating measures lie in breeding rust-resistant types and adoption of control measures. In both these Council is concentrating attention. In this connection work has been going on in Bombay, Central Provinces, Central India, Simla, Bhowali, Karnal and Agra.

MILLETS :

In connection with investigation on millets under the aegis of the Council the results show in the case of *jowar*

(i) an increase of 20 per cent yield of *jowar* in areas of scanty rainfall by dry farming methods,

(ii) control of fungus attack of *jowar* by treating the seed with copper sulphate and powdered sulphur, and

(iii) control of *jowar*-borer by mechanical methods of cleaning the stubbles after harvest and burning them.

In addition to these, investigations on control of *jowar* Striga is also in progress. *Jowar* malt has been produced and its use as a supplementary food for infants has been suggested.

In respect of maize which is a highly prolific crop, it can play a very important role in making good the deficit in our food supply if arrangements can be made for the production of hybrid maize seed. Considerable work, both of fundamental research and production of hybrid vigour on a commercial basis has been done in America. Work has been initiated under the grants of the Council at the Indian Agricultural Research Institute and in important maize-growing Provinces in India. Some work was also conducted under its grant at Lyallpur now in Pakistan.

Co-ordinated schemes have also been started on *bajra* and *ragi*, etc. yielding useful results. Trials in Baroda with *bajra* have yielded as high a yield as 731 lb. as against 531 lb. (local). In Mysore they have recorded 30 per cent more yield over the local variety. In Mysore some exotic *oodule* (millet) has yielded 1,520 lb. as compared to 360 lb. of local varieties.

PULSES :

In the case of pulses, India is very rich in species and varieties. In view of the bulk of the population being vegetarian and in order that the urgent protein requirements of the people can be met from this source, at the recommendation of Sir John Russel, the Council initiated a co-ordinated research scheme in almost all Provinces and States, on grams, horse-grams, *arhar*, *mung*, *guar*, peas, *urd* and other pulses. Already important results from different places have been obtained ; for instance, in Poona eight selected varieties of gram have given 10 to 30 per cent increase over local type. In Central Provinces one variety gave 726 lb. per acre against 226 lb. and another 1,100 lb. against 818 lb. of the control. A study of the protein content has shown that the white-seeded gram has the highest percentage of protein (23 per cent) whereas the bold-seeded variety has 20 to 21 per cent and brown-seeded variety 16 to 17·5 per cent. Wilt is a severe disease which

causes considerable damage to this crop. Work has been in progress in many places to evolve varieties resistant to this disease. Successful results have been obtained in some centres. In the case of *arhar* which is also susceptible to wilt it has been found that when it is mixed with *jowar* the incidence of wilt was much reduced, the mortality in *arhar* being 32 per cent as against 88 per cent when *arhar* was sown alone as a single crop. Mixed sowing has thus proved of great advantage.

OILSEEDS:

In oilseeds high-yielding strains have been evolved in schemes sanctioned in different provinces and varieties with higher percentage of oil have been obtained.

In Madras in the case of groundnuts selection No. AH 678 yielded 10 per cent more than AH 25 and was found superior in shelling percentage and weight-volume relationship. It also gave a saving of 25 per cent in the seed rate as its kernels are smaller in size.

FRUITS:

The importance of fruits requires no emphasis in a country like India, and here the Council has been subsidizing schemes in Madras, the United Provinces, the Punjab (now East Punjab), Bihar, Bengal (now West Bengal), Central Provinces, Assam, Hyderabad, Mysore, Coorg, etc. Investigations are carried out on various types of fruits such as mangoes, papayas, peaches, banana, etc. Fruits require a long range investigation and sometimes years must lapse before practical results can be expected. The Council has a Fruit Development Adviser to advise on fruit research.

In the Punjab in regard to the quality of Malta orange it was noted that the quality of the fruit in respect of soluble sugars and acidity was greatly improved by the application of ammonium sulphate and farmyard manure.

At Chaubattia phosphates increased the vigour of apples significantly.

Some mention should also be made of the work on cold storage, preparation of recipes and syrups, cordials, juices, candy products, etc. Canning of fruit and preservation of fruits, is conducted in Madras and at the Indian Institute of Fruit Technology in the Punjab, now at Delhi.

POTATOES:

Due to the initiative taken by the Council there has been valuable collection of potato varieties in Simla. Many of them have been brought from their original home in South America (Chile, Peru and Bolivia). These have formed material for evolving improved types of hybridization. Work on potato has been conducted from various points of view, one of

which deserves special attention, viz. the development of the tuberless sowing, by which immense saving of seed can be possible. Each tuber is capable of producing 20 to 40 plants by this method. The investigation of potato will be passed on to the Indian Central Potato Institute.

In view of the recommendations of the Famine Inquiry Commission the Council has also initiated measures to develop other root crops like sweet potato, tapioca, etc.

FODDER CROPS AND GRASSES:

For improvements of these crops the Council has sanctioned combined Agricultural and Animal Husbandry Research Schemes in different Provinces and States.

MANURIAL EXPERIMENTS:

On the manurial and cultural side the investigations initiated by the Council have led to results of enduring value. One of the first that the Council undertook soon after it came into being was the examination of the previous manurial experiments conducted all over India. These have since been embodied in voluminous publications and also bulletins and papers. These experiments however suffered from the fact that in those days the modern satistical methods were not known and the designs of experiments did not permit critical examination. Since then at the initiative of the Council manurial experiments on statistical basis have been undertaken in all the Provinces and States thus giving more reliable basis of information. In this connection investigations have been conducted with organic and inorganic manures, farmyard manure, cattle-dung, compost, oilcakes, etc. Along with these, chemical fertilizers have been tried and in all some 5,000 manurial trials have been conducted, on various crops including paddy, wheat, *jowar*, groundnuts, millets and other oilseeds and pulses. The most important conclusion is the great need for the application of nitrogen in some form or other. There is no place where the application of nitrogen has failed. Under irrigated conditions, wheat showed a universal response to nitrogenous fertilizers and manures. Under unirrigated conditions there were fluctuations but in spite of these the tendency was for a general response. In the case of paddy 20 lb. of nitrogen per acre appears to be minimum dose and there are indications that the doses can be profitably increased to 60 or 80 lb. in areas where the level of fertility is high. Oilcakes have been found as good as or often better than ammonium sulphate. The increased yield through ammonium sulphate has varied from 21 to 24 per cent in Bengal to 70 per cent in the United Provinces and Kashmir. With oilcakes the maximum increase has been as high as 110 per cent, 120 per cent, 150 per cent and even 190 per cent.

Considering that in green manuring the cost of nitrogen is only a fraction of its cost as compared to other manures like inorganic fertilizers or oilcakes, the practice of green manuring has been encouraged in all areas where water supply is assured and particularly in irrigated areas. An application of 30 to 40 lb. of nitrogen through green leaves is likely to increase the yield by 22 to 30 per cent whereas heavier doses of 60 to 80 lb. of nitrogen have given in certain cases over 100 per cent increase.

The investigations further point that there is no critical evidence to show that repeated application of the fertilizer without organic manure does harm to the soil or that repeated applications of ammonium sulphate alone over a series of years cause a fall in the yield.

In Bengal a manurial schedule has been worked out at six different price levels of paddy and four levels of ammonium sulphate. The schedule shows that manuring is paying even at the peak price of ammonium sulphate at Rs. 250 per ton if the price of paddy at Rs. 5 per maund is assured and moreover, of the two doses, viz. 20 lb. and 40 lb. of nitrogen per acre the double dose is more remunerative. In the case of some of the other provinces statistical equations have been worked out for forecasting the possible return under certain sets of conditions.

In the case of wheat manurial experiments have given increased yield varying from 6 to 63 per cent.

The experiments were not generally confined to the limited objective of only finding out the nature of response under different doses. Investigations in many cases included other important matters. Thus it was found in Central Provinces, in the case of wheat, that ammonium sulphate was very effective when applied with seed whereas soidum nitrate was best at top-dressing. The drilling of fertilizers further showed that the response per unit of fertilizer was double as compared to broadcasting In the case of *jowar* the trials at Poona suggest that the application of nitrogen at showing time is preferable to latter application. Trials at Coimbatore on *jowar* showed that there was a depression in yield by the application of inorganic nitrogen or phosphate singly but there was a phenominal increase obtained by joint application of nitrogen and phosphate, the increase being largest on poor land. In the case of *ragi* also it has been found that phosphate is an essential supplement to nitrogen under rain-fed condition in Mysore. At Dharwar in the case of *jowar* the response to oilcakes was increased threefold or more when they were applied on a basal dressing of farmyard manure. In Bihar where the soil is generally deficient in phosphate the response to phosphate under wheat takes place only when it is added as a supplement to nitrogen. In the black soil tract as well as in the Gangetic alluvium under irrigated

conditions on wheat, August has been found to be the best month for applying farmyard manure and is to be preferred to October. It has been further found that a combination of organic and inorganic nitrogen is more effective than either applied singly and that bulky manures like farmyard manure cattle-dung, compost, etc. have a lower efficiency of nitrogen as compared to that of oilcakes.

Green manuring experiments on wheat in the United Provinces show that ploughing of sand after seven to eight weeks' growth and *guara* after twelve week's growth was better than burying earlier and that if sand was allowed to manure by burying there was a depression in yield. Experiments at Lyallpur showed that green manuring supplemented by 10 lb. of nitrogen as ammonium sulphate gave per acre more grain than green manuring plus 10 lb. of nitrogen as soidum nitrate. In the case of groundnut there was an appreciable response to nitrogen from ammonium sulphate but its application at showing time yields better results than divided application. It has been found in the Punjab that correct spacing may increase the yield by 25 per cent. The response of groundnut to a combination of nitrogen and phosphate was considerable in Madras, Bombay and Central Provinces.

An interesting feature has been found in the case of linseed both in Central Provinces and the United Provinces. There was little or no response to nitrogen or phosphate singly or in combination with cattle manure. It is proposed to investigate the cause of this. In the case of *toria* it has been found in the Punjab that ammonium sulphate at 40 lb. of nitrogen per acre applied half at sowing time and half at flowering produced 1,026 lb. against 700 lb. in unmanured plot. It has been further found that if in the normal rotation in which *toria* follows wheat, the land is green manured with *guara* before sowing wheat the yield of *toria* is considerably increased due to the residue of green manure.

In the case of fruits it has been found at Sabour that ammonium sulphate and farm-yard manure applied on mangoes after harvest gave significant increase in flowering in the following season and that nitrogen significantly increased growth.

It has been found in Madras that biennial bearing in mangoes is not the inherent feature of most of the varieties and optimum crops can be secured every year provided the tree in the preceding season has made normally vegetative growth.

OTHER WORK:

The other work of the Council includes soil survey, investigation on dry farming agricultural meteorology, village project scheme. All-India Compost Scheme, investigations on medicinal and other miscellaneous plants, etc.

As regards soil survey the Council decided that before a comprehensive soil investigation was undertaken all existing information on the different soil types occurring in India should be collected and collated. Accordingly the All-India Soil Survey work was started in 1942 and the information thus collected is now ready for publication. In agricultural meteorology the Crop Weather Co-ordination Scheme deserves special mention. This work contemplates organization of a net work of stations for detailed observations of crop growth, yield and environmental and weather factors to build up crop weather statistics on scientific lines. Questionnaires were circulated to the districts and according to the replies received, crop weather calendars have been prepared for each important crop. These are of great value to the weather forecasters in issuing the *Farmers Weather Bulletin.* On this basis the weather services for agriculture have commenced with the issue of daily *Farmers Weather Bulletin* in Indian languages through All-India Radio.

It will be seen from the above that since the inception of the Council, work of far-reaching magnitude has been undertaken and the results so far achieved have been of a very high order. It may of course be asked as to how far results achieved have been adopted in the country. Here also the Council has tried within its limited funds to initiate organizations for work like seed multiplication but the major part of this work devolves on the Provinces and States and it can be reasonably expected that as days pass this will be taken up more and more vigorously. A large number of newer problems are also awaiting solution and the schemes on some of them are already under consideration of the Council.

In order to keep the work up-to-date the Council has been inviting experts from abroad to review the work in progress and lay down lines for future guidance. Sir John Russel visited the country in 1936-'37 and his report has since served as a useful guide to the Council for sanctioning schemes in different parts. Dr. Shuhart was invited in 1944 to advise on soil conservation of the country. Now Dr. A. B. Stewart of the Macaulay Institute for Soil Research, Aberdeen, who was invited to make a report on the soil fertility investigations in India with special reference to manuring, has suggested ways and means of bridging the gap between research and practice and the Council is considering a scheme to implement his recommendations.

The Council has also launched a model scheme to develop 20 villages in Delhi Province by co-ordinating work of different aspects on agriculture and animal husbandry. This is likely to serve as a guide as to how by the development of agriculture other aspects of rural life which are so intimately linked up with it, can be improved.

The total number of schemes which have been so far financed by the Council exceeds 200. On the agricultural side the total amount involved is 1·02 crore rupees.

It may as well be asked as to what value has been obtained from the expenditure of such an amount. It will however be seen from the description given in the foregoing that improved strains to suit different conditions of soil and climate have been evolved in rice, wheat and other crops. In view of the limited funds allotted to the agricultural research compared to some of the more progressive countries of the world, the work here could not be as much as should have been, but in spite of it the results have been really considerable.

The increased yield due to improved varieties have varied broadly up to 25 per cent. But even if we make a conservative estimate of only 10 to 15 per cent of return, it will show how much it has been possible to achieve within the limited funds spent. The total estimated acreage of cereals and millets in the undivided India was of the order of over 200 million acres, out of which rice and wheat in the then India occupied about 81 million acres and 35 million acres respectively. If we take the case of only these two areas the estimated production is 27 million tons of rice equal to 739 million maunds and 9 million tons of wheat equal to 243 million maunds. If we assume only a very small increase, viz. only ¼ of a maund per acre due to improved varieties (actually it is considerably more in some cases it exceeds double the normal yield) it works out to an extra yield of about 29 million maunds which even at Rs. 10 per maund offers a return of 29 crores of rupees. Compared with this the amount spent annually by the Council has been 0·56 crores and is expected to reach 1 025 crores when the schemes terminate.

As a matter of fact the amount annually spent on agricultural research in India has been very little, viz. about ¼ of an anna *per capita* per annum of 1/10th of an anna per acre of the total area. The total sum thus spent was less than two-thirds of that spent on agricultural research in the United Kingdom where the population is ⅛th and area only 1/20th of that of undivided India. It may be stated here that the Central Government of the present Indian Union in its budget for 1948-'49 have allotted a much larger sum of about Rs. 2,02,50,000 for agricultural work and improvement. This works out at 11 pies *per capita* as compared to Rs. 2 for United Kingdom, Rs. 20-14-5 for Canada and Rs. 77-9-11 for the United States of America and the amount is only 0·8 per cent of the total budget expenditure of the centre. The provinces too have allotted a higher sum and it is indeed a happy sign that the improvement of agriculture is being gradually recognized. But in order that the problems can be tackled from all angles greater scope and larger funds are an urgent necessity.

HINTS TO FARMERS

The cultivation of seedless grapevine: The variety grapevine known as seedless or Kismiss was introduced in Madura District during the year 1938 from Kabul, by the Agricultural Department, Madras and planted at Pattiveeranpatti. Gradually, the cultivation spread and to-day this crop covers an area of nearly 40 acres in Madura District and to a small extent in Ramnad and Tirunelveli Districts.

Soil: This variety grows well in well drained red loam tolerating a small mixture of gravel.

Climate: The vines are able to withstand heat but the crop fails in those places where the rain-fall is more than 40″ per year. The influence of strong wind should be considered and good and proper wind break should be provided to save the crop from Southwest and Northeast monsoons.

Planting: Pits 3′ x 3′ x 3′ are dug ten feet apart either way and two cuttings are planted in each pit and this is known as 'Square System' of planting, and when the vines reach the pandal, they are trained in opposite direction so that they may grow and cover the entire pandal. Another method of planting known as 'Trench System' is done by digging long trenches 3′ x 3′ at a distance of 30′ to 35′ apart and cuttings are planted 6′ to 8′ apart along the trench and when the vines reach the pandal they are trained in opposite directions. Cuttings 1′ long with 4 or 5 good healthy buds are selected during the June - July or December - January pruning, and if they are taken in June - July, the cuttings are planted for striking roots in a well prepared raised nursery formed close to any water source and these can be transplanted in the prepared pits during December - January. Cuttings taken during December - January can be directly planted in the permanent pits already prepared in the garden, without growing them in the nursery as being done for the June - July cuttings.

Manuring: The pits in both the systems are three-fourth filled up with well decomposed cattle manure, tank silt and green leaves in alternate layers and the remaining one-forth top portion is filled up with soil removed while digging the pits. Manuring of pits should be done three months before planting, allowing sufficient time for the green leaves inside the pit to rot completely.

Irrigation: The vines are watered once in two days just after planting and when well established, watering is done twice a week.

After-care and pruning: Two months after planting, a bamboo stick is planted close to the vine for support. Within seven months

after planting the vines grow to a height of 6′ to 7′ when they are trained on a pandal constructed for the purpose with Malakiluvai (*Balsodendron Berii*) as live standards and Agathi (*Sesbania grandiflora*) as cross posts.

Care should be taken to keep the vines free from pests and diseases appearing during different parts of the year. Twelve months after planting, the vines are given the first pruning — the important operation without which there will be no fruiting of vines. It is found by experience that vines growing vertically do not bear so well as the branches that grow horizontally, and the best results are obtained by the 'Bower' or pandal system in which the vines are allowed to spread over a pandal shaped and trained to convenience. By the process of pruning the sap is diverted to flow to the fruiting area, keeping the vines in manageable shape and makes them bear heavily. Fruits are borne near the base of the growing shoots of the season, shoots which spring from the wood of last year's growth, and vines are pruned following this principle.

Harvesting: Three months after pruning, grapes are harvested when fully ripe, and texture of the pulp and taste alone will give correct indication of ripeness, and since the colour varies according to varieties that alone is not a conclusive proof of ripeness. Grape bunches when once harvested do not ripen afterwards. Bunches should be carefully handled by the stem while harvesting, trimming and packing. Enough quantity required for daily despatch should alone be harvested. Unless facilities for cold storage are provided fruits will be unfit for despatch after twentyfour hours.

Packing: Bunches are examined and after trimming of useless cracked, unripe and rotten fruits, they are packed in bamboo baskets. Paddy straw is used as padding between each layer, and each basket holds 25 pounds or 1 maund. Small earthern pots are also used in packing grapes intended for places where there is transhipment.

Marketing: This is the most important item and unless there are facilities to market one's produce (this fruit being succulent has no keeping quality and should be disposed of as early as possible) it is not advisable and also not profitable to grow this crop on a commercial scale. There should be easy and quick transport facilities from the garden to the railway station and from there to the different parts of the Presidency. Another important factor in getting good profit is to avoid middlemen, and arrangements should be made to have Fruit Growers Association and Co-operative Societies with whose aid the produce of the various gardens may be sold with advantage. Contributed by Sri. C. Rangaswami, Plant Protection Assistant, Mycology, Madura.

REVIEW

I

W. Wouters — Contribution a l'etude Taxonomique et Caryologique du Genre *Gossiypium* et application a l'amelioration du contonnier au Congo Belge. Contributions to the taxonomic and karyological studies of the genus *Gossypium* and its application in the improvement of the cotton plant in Belgian Congo; Taxonomy of the cotton; study of the species indigenous to Belgian Congo and the cytology and phylogeny of *G. arboreum* L. and *G. hirsutum* Mill.) *Publications de I' Institute National pour L' elude Agronomique du Congo Belge. Serie Scient.* No. 34; 1948, pp. 383; bibl. with 5 plates and many figures. The work has been dealt with in three parts viz. Part I the revision of the systematics of the cottons, Part II. the study of the cotton species indigenous to Belgian Congo and Part III. Contributions to the phylogeny of the cottons—Section NeoGossypium (the tetraploid cottons.) The stages in the evolution of the different systems of classification from the time of Linnaeus 1753 to that of Hutchinson 1939 and Konstantinov 1939 has been traced. The author has critically examined the comparative merits and demerits of the different morphological characters employed in the classification of cottons. An interphyletic comparison of the genus *Gossypium* has been done and a hypothetical phyletic relationship arrived at. A chapter has been devoted to the discussion on the geographical distribution of the genus *Gossypium*. The second part is devoted entirely to the consideration of the cottons of Belgian Congo indigenous as well as wild species treated under:—

A. Cottons indigenous, diploid and Asiatico-African in origin,

B. Cottons American, tetraploid and American in origin.

The species that have been considered as truely indigenous and definitely of African origin are A. exclusively wild —

1. *Cienfuegosia triphylla* (Harv). Hoch.,
2. *Gossypium anomalum* Wavra et Peyr.,
3. *G. Kirkii* M. Mast. (*Kokia Kirkii* Skovsted).

B. cultivated —

4. *G. herbaceum* var. *acerifolium* subvar. *africanum* and
5. *G. herbaceum* var. *acerifiorium* subvar. *Wightianum.*

There are altogether 17 species cultivated and wild met with in Belgian Congo. Some of the wild species possess remarkable fibre lengths and rugosity even in unselected plants. (Staple length 27 to 28 mm). These useful species are under danger of extermination due to their being uncared for by the natives and the systematic destruction by the colonial agents. The introduction of the American cottons has taken

place along two converging but opposite direction, the older one from West to East, through the Atlantic ocean and the other more recent through the Pacific and Indian ocean. All the wild cotton plants of the Belgian Congo belong to three — different though related — South American groups. The North American group is not represented in the Belgian Congo among the wild species.

The majority of the wild cotton plants have qualities of resistance and adaptability, the fibre is rough and in some of an excellent quality, 1 to 16″ long. These allow of selection and isolation of sympodial and precacious types. The author recommends the back-cross technique to be followed in the improvement and introduction of useful characters. He pleads that these valuable wild species with their varieties should be properly preserved. The difficulty of combining the useful characters and at the same time preserving the precocity of the hybrids (seven months duration) owing to probable unfavourable linkage groups is realised. In such cases the hybrids would for the present not be useful; and one's efforts should be turned towards the production of an artificial Upland species and in increasing its variability. That objective may be attained by synthesising by paraphyletic processes of a plant as similar as possible to the Upland species. For this a more precise phylogenetic data is indispensable. In breeding cottons for Congo the immediate and future programmes should be:- (a) of first importance is to improve the Upland types of Congo (Triumph and U. 4.) by pedigree method and cross-breeding and the same time maintaining the variability of the Upland species. The study of the wild plants on a small scale and selection of sympodial and monopodial types should proceed on. (b) of second importance is the thorough selection of the types resulting from the back-crosses. (c) of next importance the creation of a more variable Upland species capable of producing types well adapted to the Congo.

In the third part the author critically reviews the earlier cytological works upto 1941, including the several interspecific hybrids, polyploids colchicine induced as well as spontaneous. The root tips for somatic study were obtained by germinating the seeds in petri dishes. Fixations were done in Navashin's fluid as modified by Dustin (1% charomic acid-75 parts; 40% comm. formaldehyde 20 parts; Glacial acetic acid 5 parts.) for 24 hours duration and stained in Haidenpeins Ironalum-Haematoxyline. A detailed account of the method employed in measuring the chromosomal lengths is given. The author finds that in *G. arboreum*, no corroborative evidence could be found to support the theory of secondary polyploidy of the 2n = 26 species. In *G. hirsutum* Mill. the autopolyploidy of the species is more proboble but taking into account the variability in the chromosomes and errors in measurements the accuracy could be only of the order of 36%. The author supports the view that this species originated as an allopolyploid.

Morphologically, half of its chromosomes easily allow themselves to be homologated with the chromosomes of an Asiatic plant; the other half made of small chromosomes, would correspond to a yet unknown parent.

The macromorphological equivalence between the cultivated American plants and the cultivated asiatic ones, is undeniable. The morphological equivalence seems to us very high for half of the set; and as other authors have proved the *intrinsic* chromosomatic equivalence (by meiotic connection among hybrids in between these two groups). *The author feels that the hypothesis that an Asiatic plant* (*G. herbaceum L.* or some other near species perhaps extinct) *must be one of the two parental species of the allotetraploid species of G. Hirsutum* as perfectly justified.

The divergences among authors may be explained by the sole chromosomatic variability. A supplementary cause of error resides *in the difficulty of bringing into evidence the point of insertion*, which entails all the dangers of a subjective interpretation.

Satellites.— It seems premature to think of the interference in phylogeny of the number and morphology of those particularities, before their nature and behaviour have been clearly established.

Cytology:

1. *The chromosomes of Gossypium*, even as to their relative length with regard to each other (or idiogram) *are not constant*. They present on the contray, a variability which can be figured out, and which has to be taken into account when comparing idiograms with each other.

2. *Satellites:* With the Cotton plant no question would arise about the organites attached to the chromosomes by a filament and capable of showing or otherwise according as they are stained or not. There would rather be a question of stained extremities of chromosomes, preceded by a zone which can appear achromatic in conditions not yet defined. If the zone appears achromatic, it determines a chromosome apparently accompanied by a satellite; if it remaines stained during the differenciation, the chromosome will appear as an ordinary chromosome of the same length as the satellite chromosome — including both satellite and achromatic zone.

3. The various fixation agents produce on the chromosome variable morphological modifications, hence we cannot compare nuclear contents which have not been fixed in identical conditions.

4. The subjective factor plays unhappily an important role in cytological observation, which it is sometimes possible to reduce, *but always impossible to completely suppress.* It seems therefore desirable: (a) to give as far as possible the preference to permanent preparations which alone allow to re-examine the interpretations a few weeks after the observation; (b) to number the preparations, drawings of which together

with observation accounts are consigned in publications; and to deposit them in a scientific Institution where they can be consulted, as a material for comparison, by the specialists.

That method, the most useful in Systematic Botany and in Entomology, would probably be most useful in cytological research. It would allow to show that the majority of the divergences and theoretical controversies, based on personal observations and experiments made separately, result in most cases from differences of interpretation. — Rev. Fr. Leepen, Kodaikanal.

II

CYTOGENETICS AND PLANT-BREEDING: By S. N. Chandrasekharan, M. A., and S. V. Parthasarathi, B. Sc. (Ag.) M. Sc., with a forward by K. Ramiah, L. M. Sc., Dip. Agri. (Cantab)., M. B. E., F. N. I., F. A. Sc., *Published by Varadachary, 1948. Price Rs. 12—8—0.*

The present century has witnessed the rapid advance of the science of genetics and its application to plant-breeding. In India a considerable volume of useful work in this field has been done, but the record of this work lie scattered in several publications, or unpublished reports, which are not readily accessible to the students and teachers of biology at our colleges.

Genetics and plant-breeding form an important part of the syllabus in the Agricultural Colleges and the lack of suitable text books on the subject dealing with Indian crop plants has been felt both by students and teachers.

"Cytogenetics and plant-breeding" by S. N. Chandrasekharan and S. V. Parthasarathi is an attempt to satisfy this need, and the authors deserve much praise for making this pioneer attempt and succeeding in bringing out a good text book on a very difficult subject.

They have taken great pains over the book, and have brought within its compass a large mass of relevant and useful information relating to Indian crop plants and the text is illustrated with a number of photographs and diagrams.

The matter is clearly presented in a readable form and the beginner or layman would find no difficulty in following the book and acquiring a basic knowledge of the fundamentals of the science of crop improvement.

The few chapters in the end of the book are devoted to 'statistics in relation to plant-breeding', and to explaining the technique of laying out field trials for the benefit of beginners.

The book is a useful addition to the few good text books on biological sciences published in India.

Extracts

Why India Starves and the Remedy.

Starvation of the soil is the root cause of our own starvation. Mother Earth is truly a living being and if we do not nourish her she cannot nourish us. Man must have noticed the invigorating effect on the earth of the dung and urine of his cattle and how the sweepings of his cow-sheds after they had rotted gave out a smell like rich vigur soil. In this way he must have arrived at the preparation and use of farm yard manure, the roughers and oldest form of "compost". In some countries this process developed naturally through age long intelligent practices of the peasantry into a highly advanced method of composting as in China where the cultivator has developed a record yield per acre. In others it remained at or reverted to the primitive stages as in the Indian villages to-day. With the advent of modern science and mechanisation of Agriculture came the introduction of artificial manures especially in the East. Gradually livestock got reduced and the countries which started the modern methods began to recognise their dangers and the scientists are now recommending compost manure as the best of all nourishments for the soil. It contains something of everything that is present in the artificial manures and in addition it is full of rich moisture retaining body building *humus*.

What exactly is this compost? It is simply rubbish mixed thoroughly with either cattle dung and cattle urine or with human excreta. It is easy to make, the necessary ingredients are all present in our village, the villagers ordinary tools are sufficient for the job and the preparation needs no special technical knowledge. Once the method of preparation has been explained, any peasant can prepare it successfully for himself. The only real obstacles in the way are lack of knowledge, indifference and laziness. Once the arch enemiers our progress are mastered we shall get over food shortage, high prices, insanitation and ill-health.

Is not such an achievement worth our fullest endeavour? (Extract from "Why India Starves" by Srimathi Miraben).

Prize for groundnut hand Decorticator. A prize of Rs. 2,000 will be awarded by the Indian Oilseeds Committee to any person or body who designs the best method of groundnut hand decorticator and demonstrates its working to the satisfaction of the Indian Oilseeds Committee or competent body to be appointed by it. Entries accompanied with diagrams showing details of the machine should be submitted to the Secretary, Indian Oilseeds Committee, Ministry of Agriculture, New Delhi, so as to reach him not later than October 31, 1949. Competitors should be prepared to demonstrate the working of the machine at such place and time as directed by the Committee.

The groundnut hand decorticator should fulfill the following conditions :—

1. The hand decorticator should as far as possible, be made of material easily available in the villages. It should preferably be made of wood and should have as little iron part as possible.

2. The construction should be simple enough so that repairs and spare parts can be provided in the villages by the village carpenter or the village blacksmith.

3. The grates or sieves used in the machine should be adjustable to enable proper decortication of groundnut pods of different varieties and sizes.

4. The turnover and cost of decortication should compare favourably to those of power decorticators.

5. The proportion of split and broken kernels, 'nooks' and unshelled pods in the decorticated produce should be as little as possible.

6. The cost of the hand decorticator should be reasonable and should not exceed Rs. 100. (Indian Farming—January 1949.)

Pruning Tomatoes. Tomato is one of the most valuable of the vegetables as it can be used in many forms and is an important source of vitamins. Tomatoes which ripen on the plant contain higher vitamin contents than those picked green and ripened indoors. Since ripened fruit is desirable in as large quantities as possible, the tomato plants should be pruned to a single stem and tied to stakes. This practice has proved best in North Eastern Saskatchewam (in Canada) in the production of early, larger and cleaner fruit in the less disease, injury and more convenient harvesting. Stakes of wood one inch by two inches and five feet long are satisfactory-small stakes may be cut from the bush and used. The stakes are driven a few inches from each plant to a depth of 10 to 12 inches and the plants are tied to them. The injury to the plant is less if the stakes are driven soon after planting. Tying the plant to the stake should be continued as the plant grows. Pruning the plants to one stem consists of cutting or pinching out all side or lateral branches as soon as they appear. During the growing period the plants should be examined at least once in a week and all the side and lateral branches should be removed. This tends to throw all the vigour of the plant into the formation and production of fruit. After three or four flower clusters have set fruits, the top of the plant should be pinched off or cut first below the next clusters of flowers that appears above the clusters to be retained. Any leaf overhanging a cluster of fruits may also be removed to allow sun and air to speed the development and ripening of the fruit. This practice has resulted in early production with larger fruits and heavier yield. Bush types are not adapted to staikng and pruning. (Extract from Indian Farming—November 1947).

Improved Production of Potatoes In order to effect improved production of potatoes two points must be borne in mind.

(1) Growing of good varieties.

(2) Maintaining of the health of the crop.

It is of paramount importance to keep the crop free from disease. The plants while growing on the field are regularly inspected, rogues are culled to keep up the purity and diseased plants are removed from the field to prevent further continuation. For the same reason potatoes intended for seeds are lifted immature. Another method of great consequence for the production of seed potatoes in the Netherlands is keeping the tubers in stores mainly built of glass. The advantages resulting from this method are: No damage by pest, no fumentation, negligible amount of rotting and continuous control is possible. The seeds can be planted after sprouting. Short strong sprouts are developed under exposure to-day-light. Planting of sprouted sets results in regular germination, an advantage when examining the crop for the detection of diseased plants. (The Netherlands has a fairly mild marine climate with wild winters and cool summers, prevailing high relation humidity of the air, large amount of cloudiness (0·6—0·7) and little sunshine (31% of sunny days). The average temperature is 10°C with a maximum of 19°C in July and a minimum of 2°C in January. The average rainfall is about 700 mms. per year.)

(Extract from Dutch Agriculture—'Facts')

Agricultural News-Letter — Madras

Mixed Cropping of Groundnut and Cotton. Experiments conducted at the Agricultural Research Station, Lam, Guntur District, on mixed cropping of groundnut and cotton in the proportion of eight of the former to one of the latter showed that the yield of bunch groundnuts was not affected and that cotton recorded yields ranging from 260—380 lbs. of seed cotton per acre. Both cotton and groundnut were sown on July 22, 1948 and groundnut was lifted on November 12, 1948. Among the various varieties of cotton tested for mixed cropping, cotton types from U. P. happened to be the earliest and the next in order being 197—3 from East Khandesh and 881 F. from Adoni. U. P. types being early, shed flowers and bolls, while the others escaped this defect by their late maturity and are of better quality and ginning outturn. Farmers of the Ceded Districts, the Circars and Nellore are advised to give this mixed cropping a trial. Even at a modest estimated average production of 50 lbs , of lint per acre, it should be possible to produce two lakhs bales extra.

Pre-sowing Treatment to Wild Indigo Seed. Wild indigo (Tephrosia Purpurea) is a useful green manure crop for sandy and laterite soils, and the stand of the crop depends upon the quality of seed. Usually, the seed is procured indifferently and stocks are carried over from season to season. Further, the seed coat is hard. In order to increase the percentage of germination, the seed requires pre-sowing treatment. Wild Indigo seeds giving normally 25 to 40 per cent protracted germination, under untreated condition, record 75 per cent in about 4 or 5 days by steeping the seed in hot water of 80—90°C for five minutes. This method is preferable to the usual practice of pounding the seed with sand. However, old seeds which have lost their vitality do not respond to this treatment.

Co. 473. A New Variety of Cane. Co. 419 has been popular with the growers and sugar-mills for the past ten years, owing to its wide adaptability. It has been reported that in the Kirlampudi area Co. 419 was so highly infested with scale insects that ryots have been actively considering the replace Co. 419 with a better type of cane.

Among the varieties under trial at the Agricultural Research Station, Samalkot, Co. 473 has been marked out as a very promising cane, to replace Co. 419. Co. 473 has given 58—4 tons on an average for the past two seasons against an yield of 42·2 tons by Co. 419. Even in the month of March, the sucrose percentage of Co. 473 mounts to 20·95 per cent, as compared to 17·30 % in Co. 419. It is a greenish yellow cane with medium sized internodes. It can be distinguished by prominent traingular buds. Its rind is thick and does not form pith and hollowness. The rich sweet cane, POJ. 2878, the wonder cane of the world, being one of the parents, should afford sufficient confidence of its good performance to the cane-growers.

Seeds from Pods Prosopis Juliflora. Prosopis Juliflora, a fence plant, possesses a thick leathery pericarp, which impedes easy and quick extraction of seeds. The pericarp gets softened by moistening the pods with 1·4 sulphuric acid. In about 12 hours, the dilute acid acts on the pericarp. The disintegrated pods are then washed with water and dried in the sun. The dried stuff is pounded to extract the seed.

Co. 25 and 26. Blast Resistant Paddy Strains. In the 1948—49 season, the Taladi (Second) crop in the districts of South Arcot and Tanjore was observed to be severely attacked by *Stem-borer* and *Helminthos-porium.* In the middle of these affected areas, plots planted to Co. 25 and Co. 26 were found to be comparatively resistant to the pest and disease. These are recommended for a large scale cultivation in the Southern and Central Districts. Arrangements are being made to stock large quantities of seed for distribution in the next crop season.

Ideal Table Mangoes. A large number of crosses in the farm seedlings of mangoes has been produced at the Agricultural Station, Kodur, with a view to breed ideal table or juicy mango variety, with economic characters which are now dispersed in a number of commercial varieties. A study of the performance of such of the hybrid progenies as have now come to bearing, resulted in the making out of four hybrids, namely K. O. 3/9, K. O. 9/3, K. O. 9/3, K. O. 7/5, K. O. 11/13 for outstanding merit. A limited number of colonal progenies of the above are now under production at the Fruit Research Station, Kodur, for distribution.

Ducks for Combating Pests. A severe attack of the striped bug was noted on a compact block of 13 acres, at Kattuputtur in the Tiruchirapalli District. A flock of about 1,000 ducks was let into the field as an experimental measure. The result was astounding. Each duck was capable of accounting for about 500 insects in the course of a day. The whole field, infested with the insect, was cleared of the pest in the course of five days. There was no need for treating the field with chemical insecticides.

Gammexane Saves Paddy from Caterpillar. During the month of January, reports were received of the appearance of the swarming Caterpillar (Spodoptera mauritia) pest in the second crop (dalva) paddy seed-beds in the Bhimavaram taluks of the W. Godavari District and Amalapuram and Razole taluks of the East Godavary District. Due to the remedies of flooding kerosination and letting in ducks approximately 60 acres of seed-beds distributed in small patches over the area, were saved. But the pest re-appeared in the broadcasted and transplanted fields. The usual mechanical methods could not be adopted in the transplanted crop, because the bunds were not high. To meet this rapid spread of the pest in the transplanted fields, Gammexane D. ·025 was rushed to the area. The success with the use of Gammexane D. ·025 against swarming caterpillers was so telling that ryots regretted that this was not tried earlier. A total area of 600 acres was estimated to have been treated with the insecticides (Gammexane). It is effective on young caterpillars. It was used at the rate of 12 to 20 lbs., per acre, costing Rs. 1–14–0 to Rs. 3—2—0 for the insecticide and Rs. 3 for manual labour to dust. It is estimated that on an average 7½ bags of paddy, costing Rs. 80/-per acre, was saved by spending Rs. 5/- to 6 in the control of the pest. In addition to the direct saving of the affected crop, a considerable area has been saved by this timely action, in checking the spread of the caterpillar marching from field to field, till they are stopped by control measures or the setting in of the pupation stage. The total paddy crop saved from this dreaded pest on paddy in the second crop season of 1949 in the Godavari Delta can be estimated at 3,000 acres and the value of the produce of the crop so saved may be computed at a very modest estimate to the tune of Rs. 2,40,000.

Sunbeam Mix-Master At the Fruit Product Research Laboratory, Kodur, an elegant machine has been recently obtained for extracting orange juice. It is a power driven (AC, DC), unit, working a revolving bar and having glass bowls for holding the juice. It is called the Sunbeam Mix-Master and is an American machine, costing about Rs. 320/-. It is very useful for institutions, hospitals, clubs, ice cream parlours, hotels and restaurants.

Improved Dry Farming Practices. Owing to the failure and very often ill-distributed nature of rains in Bellary District in the taluks of Uruvakonda and Gooty of Anantapur District and Pattikonda of Kurnool District, which form the "dry farming zone" of the Province, famines are frequent. As a result of the research work that has been in progress for some years past at the Agricultural Research Station, Hagari, the following improvements in dry farming practices are recommended for adoption:— (1) Growing of quick maturing and high yielding strains: Cotton H. 1., Sorgham M. 47-3, Setaria H. 1 and Setaria H. 2. (2) Adoption of wider spacing of 18" for Sorghum and 36" for cotton. (3) At the last preliminary cultivation operation, bunds are to be formed, with

the bundforming implement, dividing up the field, in compartments of 5 to 10 cents. The bunds help to hold up the rain water for a longer period, thereby resulting in greater absorption of the rain water by the soil. Owing to the extra moisture, so made available, crop yield are increased. An investment of As. 12 per acre is this operation results in an increase in the produce worth Rs. 5/-.

Cattle Inoculation. During the period ending April 30, 1949, 51502 preventive inoculatious were done by tue Animal Husbandry Department for animals against the various contagious diseases, as against 44,677 in the previous two months.

Gleanings

Pressure cooking does not destroy vitamins. Dietitians study a tricky problem: Changes in diet can have unforeseen and serious consequences. In the East, beri-beri has in the course of centuries destroyed millions of lives merely because polished rice — which lacks the husk in which vitamin B of the grain is stored -- came to be considered more palatable than unpolished rice.

Today, the rapidly increasing popularity of pressure cookers is setting dietitians a serious problem : they are busy finding out what effect this new kind of cooking has on the nutritional value of food. This research is of the greatest practical importance for it would be a disastrous paradox if one branch of applied science — the use of high pressure steam to speed up cooking and made it cheaper — conflicted with another — the maintenance of health by properly balanced diets.

Fortunately, however, it seems that, rather unexpectedly, this danger will not materialise. Indeed, thanks to this research, the protagonists of pressure cooking can claim as a point in its favour that it enhances the vitamin content of food, rather than reduces it. Thus in seeking to expose a possible danger the dietetic experts seem to have brought to light a real advantage.

Simple principle: The principle of the pressure cooker is very simple. The temperature at which water boils depends on pressure. At ordinary pressures, it boils at 212°F (100°C). At lower pressures, on high mountains or in high-flying aircraft for example it may boil at a much lower temperature. Under such conditions it may be impossible to make an egg set by boiling it and meat is difficult to make tender however long it is stewed. To overcome such difficulties pressure cooking has long been resorted to. During the last few years, however, the pressure cooker has become very popular for ordinary domestic use under quite normal conditions. By heating water in a sealed container at quite a moderate and safe pressure — often 15 lbs. per square inch — it can be boiled at 252°F (122°C) instead of the normal boiling temperature. This extra 40° makes a lot of difference — food cooks in a fraction of the time usually needed and much less fuel is needed. There is an obvious danger in this method however. Two important vitamins — vitamin C, whose lack causes scurvy, and vitamin B whose lack causes beri-beri — are both slowly destroyed by heating. Consequently, it was feared that as quite substantial amounts are lost by ordinary boiling, the even highes temperatures reached in pressure cooking might cause almost all of both these vitaminr to disappear before the food reached the table. In families which relied entirely on pressure cooking this might eventually lead to the appearance of both scurvy and beri-beri.

Exhaustive experiments: Exhaustive experiments recently carried out at King's College of Household and Social Science — a part of London University — have confirmed that this new method of cooking is safe in this respect. Over 5,000 tests were

made altogether in which many kinds of everyday vegetables — cauliflower, carrots, turnips and several others — were cooked under the same sort of conditions as would be found in an ordinary kitchen. The results showed that, contrary to expectation, pressure — cooked vegetables contained more vitamin C — the anti - scurvy vitamin — than ordinary boiled ones. Other experiments, which have been confirmed in other British laboratories, show that vitamin B1 also is not destroyed so greatly. Naturally, an attempt has been made to find out why despite higher temperatures there is more vitamin left. There seem to be three main reasons. The first and foremost is the fact that very little water is put into pressure cookers and even this small amount never comes into direct contact with the food. When food is boiled in the ordinary way, some. vitamin is lost by heat, but a great deal more is lost by being dissolved out by water. As much as half the vitamin C may be lost in this way and thrown into the kitchen sink. Another important factor is that in the pressure cooker the food is heated to its highest temperature in a very short time whereas when boiled in water it takes several minutes. It is during this preliminary heating that the vitamin is most likely to be destroyed. Yet another point is that in the pressure cooker there is no air, only steam, so that no vitamin is lost by chemical combination with oxygen.

Minerals: Vitamins are not the only important substances which boiling water may dissolve out of food — valuable minerals, such as iron, phosphorus and calciumt are also lost. Experiments in a number of laboratories have shown that scarcely any of these are lost when the pressure method is used. The pressure cooker has gained in favour so rapidly during the last few years — when economy in time and fuel have become so vital — that we may well be starting an era in which its use becomes common place. It is, therefore, gratifying to know that our scientists are keeping a watchful eye for any dangers which may result from such a departure from kitchen convention. (B. F. 1013 British Information Service.)

Locusts are not invincible: As the prevention of locust invasions is still imperfect, new invasions may come, but recent experience has shown that locusts are not invincible. Man can now defend his crops against the invaders, and sooner or later locust plagues will be a thing of the past

For the last 20 years, scientists of many nations have been studying locusts in Africa, Arabia, India and elsewhere, trying to find out all about their life and habits in order to fight and eliminate their ever threatening menace. To make these studies, scientists travelled through inhospitable deserts and pestilential swamps; they lived for months amongst locusts and learned their ways. They also collected reports on swarm movements in all countries of Africa and plotted them on maps so as to know how locust invasions spread from one country to another, and particularly — to discover where and how the swarms originate. The most striking fact about locusts is that their swarms are not always present. There are periods of several years when there are no swarms at all. It has always been a puzzle — what happens to locusts when there are no swarms? This puzzle has now been solved. It has been found that, when swarms disappear, locusts continue to live in certain places, but they are few in number, do no harm and pass unnoticed by ordinary man. It is more remarkable, however, that even scientists in the past overlooked such non-swarming locusts, because they change their appearonce when not in swarms and look like ordinary grasshoppers. A young non-swarming locust is green, while a locust from a swarm is coloured orange and black.

Under constant watch: The solitary locusts survive only in a few places, and when the season is favourable, they increase in numbers, come together in dense groups and change their colour, becoming dreaded swarming locusts, which travel fast and wide. Once that secret of the change in locusts became known, the places were solitary locusts survive were discovered and the sources of swarms were no longer unknown.

These places are now kept under constant watch, to see whether locusts begin to change If this is noticed, measures are taken to kill off the first swarms, which are yet small in size. In this way, locust invasions can be prevented. Unfortunately, many of these original locust sources are in wild uninhabited countries, where it is difficult to maintain a strict watch. Therefore, there are still places where swarms can develop unobserved and locust invasions are still possible. However, the knowledge of swarm movements is sufficiently good now to enable scientists to make predictions, so that every threatened country is always warned in time to make preparations for defence. During the last war, vast swarms of locusts threatened crops in East Africa and the Middle East, and famine was expected, but warnings were sounded and anti-locust measures organised on a large scale. Thousands of troops, under the direction of scientists, were used to track down locusts and to scatter poisoned bran which locusts love in front of the advancing hordes. This anti-locust war was entirely succesful. Only in few cases was there damage to crops, and famine was averted. [B. F. 1096 British Information Service.]

Grass cubes as cattle feed: Grass dried and pressed into cubes will feed thousands of dairy cows in Britain next winter. This revolution in feeding — which makes grass last all the year round — will save expenditure on imported feeding stuffs Plants to dry grass and convert it into bales or cubes are being erected in many countries. Most of these are owned by farmers either through co-operative societies or local associations. The associations do the work of manuring, cutting, carting and drying and returning the final product to the farms.

The crop is cut two or three times a year and the average production of dried grass is two tons an acre. The cost averages about £ 15 (Rs 200) a ton — nearly £ 10 (Rs 133) less than imported feeding stuffs. Farmers say that cows milk better on and are much healthier. A big stimulus to this scheme has been provided by Government grants. [B. F. 1279 British Information Service.]

New orchard sprayer Impresses: A new Australian machine for spraying crops and orchards with insecticides and for similiar purposes is said to be very successful. The Wilmist dispenses with booms, and is a single compact unit. It can be mounted on a trailer, utility or truck.

A 3·4 h. p. motor is needed to drive a propeller at 3,000 revolutions per minute in a wind tunnel 14 inches in diameter. This produces a 60 mile an hour blast of air through a pipe shaped like a fish-tailed exhaust pipe. Spraying mixture is pumped through jets into the air stream at the mouth of the duct, and throughly atomised.

It is said that the machine is very economical. Whereas old-type sprayers usually needed about 100 gallons of liquid to cover one acre, the 'Wilmist' sprayer can out this down to between 5—10 gallons according to the material being sprayed and the requirements of the crop. [A. G. N. 246]

Toads eat bees: Some bee-keepers in Queensland and northern New South Wales are concerned about the increasing prevalence of the Giant Toad. This unpleasant-looking creature, known as '*Bufo Marinus*' has a voracious appetite for catching them.

The toads feed at night. Taking up a strategic position at the entrance to the hive, they catch the bees as they pass in and out. One bee-keeper maintains that he has seen two-and three-story hives destroyed in 3 weeks by these Giant Toads. A number of toads may attack a single hive. The toad, which exudes a poisonous slime, has also been blamed for the death of cats, dogs and poultry. No convenient way of destroying the toads has yet been found. [A. G. N. 246]

'Earthworm Enterprises': Most farmers and gardeners appreciate the value of worms in improving the soil, and in some places the land has been raised to a higher standard of fertility by encouraging the multiplication of the worms. Mr. Harold Karp, of Randwick, Sydney, claims that if home gardeners used more worms they would get better flowers and vegetables. With a box of 250 worms as breeding stock, he thinks any garden could be started along the road to high fertility, and he has set out to make the necessary worms available. Last December he took up worm breeding as a hobby, but he has now registered 'Earthworm Enterprise' as a business, and has built up a 'stud' of half a-million worms. He intends to sell them at from 15 shillings to one pound a box according to quality.

He apparently has a more ambitious rival in the United States, who recently sought the help of a Sydney newspaper to arrange for the export of some giant earthworms from Gippsland. This worm, technically known as *'Megascolides australis'*, may grow to a length of 10 feet and as thick as a man's thumb. However, the prospects of acclimatising these worms in a strange environment are poor. The giant worm is so discriminating in its surroundings that it is found only along the banks of the Bass River in Gippsland, and no where else in Australia or the world. [A. G. N. 242.]

Crops and Trade Reports

Statistics—Crop—Cotton—1948—1949-Fourth Forecast Report: The average area under cotton in the Madras Province during the five years ending 1944—'45 represents 10·7 per cent of the total area under cotton in India.

2. The area sown under cotton upto the 25th January 1949 is estimated at 1,378,700 acres. When compared with the area of 1,286,000 acres estimated for the corresponding period of last year, it reveals an increase of 7·3 per cent.

Three hundred and seventy thousand six hundred acres have been reported as sown since the last December forecast was issued. This extent comprises 202,500 acres under Tinnevellies including Karunganni in Coimbatore, 73,900 acres under Cambodia, 60,200 acres under Westerns (including Mungari cotton), 12,900 acres under Warangal and Cocanadas, 18,000 acres under White and Red Northerns, 2,600 acres under Salems and 500 acres under Chinnapathi or short-staple cotton. The area sown in December 1948 and January 1949 is less than that sown in the corresponding period of the previous year by 1·2 per cent.

3. When compared with the area estimated for the corresponding period of the previous year, an increase in area is estimated in the districts of West Godavari, Kurnool, Bellary, Anantapur, Coimbatore, Ramnad and Tirunelveli and a decrease in area in the other important districts. The variations are marked in Guntur (—6,100 acres), Kurnool (—18,000 acres), Bellary (—40,000 acres), Anantapur (—13,700 acres), Nellore (—6,400 acres), Salem—5,500 acres), Coimbatore (—29,800 acres), Ramnad (—9,300 acres), and Tirunelveli (—7,000 acres).

4. The area under irrigated cotton, mainly Cambodia, is estimated at 132,100 acres, as against 126,100 acres estimated for the corresponding period of the previous year.

5. Pickings of the mungari or early sown cotton crop in the Deccan are nearing completion.

The crop has been affected by insufficiency of rainfall in parts of the Anantapur and Salem Districts. In the Bellary District the crop is reported to have been subject to attacks of hairy caterpillar pest in the early stages of its growth, and to show signs of drooping and shedding of bolls and flowers. The yield per acre is estimated to be normal in the districts of East Godavari, West Godavari, Krishna, Guntur, Tirunelveli, Malabar and South Kanara and below the normal in the other districts.

The seasonal factor for the Province as a whole works out to 91 per cent of the average which is the same as that estimated for the corresponding period of the previous year. It is, however, too early to estimate the yield with accuracy as the harvest has not yet commenced in the major portion of the area and much will depend upon the future weather conditions in the districts.

6. The average wholesale price of cotton lint per imperial maund of 82 2/7 lbs. or 3,200 tolas, as reported from important market centres on 26th March 1949, was Rs. 57—11—0 for Cocanadas, Rs. 64—4—0 for White Northerns, Rs. 65—13—0 for Red Northerns, Rs. 60—1—0 for Westerns (Mungari), Rs. 65—1—0 for Westerns (Hingari), Rs. 83—1—0 for Coimbatore Cambodia, Rs. 74—3—0 for Coimbatore Karunganni and Rs. 57—12—0 for Nadam cotton. When compared with the prices published in the last report i. e., those which prevailed on 8th January 1949, those which prevailed on 8th January 1949, these prices reveal a rise of approximately 27 per cent in the case of Westerns (Hingari), ?5 per cent in the case of Westerns (Mungari), 19 per cent in the case of Cocanadas, 10 per cent in the case of Nadam cotton and 1 per cent in the case of Coimbatore Cambodia.

Cotton Raw in the Madras Presidency: The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 to 10th June, 1949 amounted to 163,051 bales of 392 lb. lint as against an estimate of 301,800 bales of the total crop of 1948—'49. The receipts in the corresponding period of the previous year were 212,812 bales. 230,590 bales mainly of pressed cotton were received at spinning mills and 1,705 bales were exported by sea while 53,817 bales were imported by sea mainly from Karachi, Bombay and Egypt. (From the Director of Agriculture, Madras)

MADRAS UNIVERSITY

The following is the list of Register numbers of successful candidates in the recent B. Sc. (Agriculture) Examination held in May 1949.

First Examination:— 1 2 4 6 to 8 10 13 14 16 to 18 20 to 22 24 to 36 38 39 41 to 46 48 51 to 55 57 to 64 66 67 69 to 78 80 to 95 97 to 99 and 101..

The results of candidates with register numbers 5 11 23 50 65 68 are withheld.

Second Examination:— 102 to 20 22 24 27 to 32 34 35 37 39 40 42 to 51 53 54 56 58 59 61 to 65 67 to 74 75 79 to 81 83 to 97.

Passed in all subjects except Animal Hygiene:— 121.

Passed in all subjects except Agriculture:— 125 133 141 176 178 182.

Passed in all subjects except Agriculture Engineering:— 138 152 160.

Final Examination:— Second Class: 184 to 257 59 to 62 and 64 to 89.

Weather Review — For May 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars	Gopalpore	0·3	−1·8	0·8
	Calingapatam	1·2	−1·4	1·6
	Vizagapatam	5·9	+3·9	6·5
	Anakapalle*	4·2	+2·0	6·4
	Samalkot*	1·2	−0·2	...
	Kakinada	1·3	−0·2	3·5
	Maruteru*	3·8	+2·8	4·1
	Masulipatam	2·8	+1·5	3·2
	Guntur*	4·6	+2·3	5·1
	Agrl. College, Bapatla	2·3	+1·5	2·8
	Veeravanam (College Farm)	1·4	(x)	1·8
Ceded Dists.	Kurnool	2·6	+1·5	4·1
	Nandyal*	2·1	+0·4	2·8
	Hagari*	2·5	+0·3	3·2
	Siruguppa*	2·5	+0·5§	2·5
	Bellary	2·4	+0·5	2·4
	Rentichintala	1·8	−0·7	2·0
	Cuddapah	2·5	+1·5	2·5
	Anantharajpet*	3·5	+0·6	3·5
Carnatic.	Nellore	9·1	+8·0	9·5
	Buchireddipalem*	5·4	+3·1	5·4
	Madras	8·0	+7·0	8·9
	Tirurkuppam*	6·5	+4·1$	6·5
	Palur*	4·5	+0·9	4·5
	Tindivanam*	1·0	−2·9	1·5
	Cuddalore	4·2	+3·2	4·3
Central.	Vellore	2·7	+0·4	4·2
	Gudiyatham*	2·3	−1·7	2·3
	Salem	2·7	−1·9	8·6
	Coimbatore (A.C.R.I.)*	2·9	+0·4	4·3
	Coimbatore (C.B.S.)*	2·6	+0·2	3·7
	Coimbatore	3·5	+1·0	5·0
	Tiruchirapalli	3·4	+0·8	4·6

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	4·1	+2·5	4·7
	Aduturai*	3·4	+0·7	3·4
	Pattukottai*	1·5	−0·7	2·9
	Mathurai	4·7	+2·0	11·5
	Pamban	1·5	+0·5	8·3
	Koilpatti*	4·2	+2·1	6·6
	Palamcottah	6·2	+4·6	8·0
	Ambasamudram*	1·6	−0·5	5·4
West Coast.	Trivandrum	11·1	+2·3	15·4
	Cochin	19·4	+7·7	25.9
	Calicut	22·8	+13·9	32·4
	Pattambi*	17·2	+10·1	19·8
	Taliparamba*	19·1	+12·8	20·4
	Nileshwar*	24·5	+14·6	26·6
	Pilicode*	19·6	+11·7$	20·9
	Mangalore	23·1	+15·4	23·1
	Kankanady*	22·9	+16·2	22·9
Mysore & Coorg.	Chitaldrug	0·8	−2·1	1·1
	Bangalore	1·8	−2·4	3·7
	Mysore	5·4	−0·2	7·5
Hills.	Mercara	10·6	+5·4	13·7
	Kodaikanal	5·8	−0·6	9·3
	Coonoor*	3·5	+1·0	9·2
	Ootacamund*	5·2	...	7·7
	Nanjanad*	6·0	+0·5	8·2

Note :—
(1) * Meteorological Stations of the Madras Agricultural Department.
(2) Average of ten years data is taken as the normal
(3) x Readings are being recorded only from February 1948.
(4) § Taluk office normal is 1·72". and Rainfall is 2·25".
(5) $ Average of six years data for Tirurkuppam, and seven years data for Pilicode is given as normal.

Weather Review For May 1949

Due to the western disturbance noted over the West Punjab on 12—5—49, a marked increase and extension of thunderstorm activity over the country east of Longitude 75°E were recorded on the very next day. On the third day, the western disturbance apparently passed away across the western Himalayas. The net result was the conditions became unsettled on the same day in the south Bay of Bangal.

Owing to the trough of low pressure in the southwest Bay of Bengal on 15—5—49. monsoonic weather was experienced along the west coast on 17—5—49.

A depression in the southwest Bay of Bengal which was formed on 21—5—49, caused heavy rains along the eastern coast, particularly in Madras and Nellore on 22—5—49, A temporary advance of the monsoon was in evidence in Malabar. In fact, on 23—5—49 the South West Monsoon advanced into the South East Arabian Sea and caused widespread and local heavy rains along the west coast.

The monsoon appeared to have started in South Malabar on 28—5—49 and continued to be active only during the remaining days of the month when it again became feeble.

Inspite of the disturbed weather conditions, Rentachintala, Cuddapah, Nellore and Kurnool recorded respectively maximum temperatures the tune of 111°F, 110°F, 109°F and 106°F in the second half of the month.

Fairly widespread thundershowers occurred in different parts of the Presidency. The noteworthy falls in the month are as detailed below:—

Date	*Place*	*Rainfall in inches.*
8—5—49	Palghat	2·7
13—5—49	Ongole	3·8
14—5—49	Mathurai	2·4
17—5—49	Cochin	3·8
,,	Trivandrum	3·7
,,	Calicut	3·3
22—5—45	Madras	6·4
,,	Nellore	6·1
23—5—49	Mangalore	6·7
,,	Alleppey	2·5
,,	Anantapur	3·0

M. B. V. N. & C. B. N.

Departmental Notifications

GAZETTED SERVICE—POSTINGS AND TRANSFERS.

Name of Officers	From	To
Janab Abdul Samad Sahib.	Superintendent, A. R. S. Aduthurai,	Assistant Paddy Specialist A R. S., Pattambi.
Sri Hanumantha Rao, K.	Assistant in Paddy A. R S , Mangalore,	Gazetted Superintendent A. R. S. Nanjanad.
,, Jagannatha Rao, C.	Superintendent, A. R. S. Hagari	Assistant Cotton Specialist A. R. S. Nandyal.
,, Kalyanaraman, S. M.	Superintendent, A. R. S. Koilpatti,	Assistant Cotton Specialist A. R. S. Koilpatti.
,, Narasimha Rao, M. P.	Superindent, A. R. S. Maruteru,	Gazetted Superintendent A. R. S. Maruteru.
,, Ponniah, B. W. X.	Assistant in Millets, Coimbatore,	Gazetted Superintendent Koilpatti.
,, Ramana Rai, K. S.	D. A. O. Saidapet	Gazetted Assistant Lecturer in Agriculture, Bapatla.
,, Ramaswami, K.	Superintendent, A. R. S. Aduthurai,	Gazetted Superintendent A. R. S. Aduthurai.
,, Ramachandra Rao, S.	Assistant in Paddy A. R. S., Maruteru,	Gazetted Superintendent A. R. S. Maruteru.
,, Rama Rao, V.	On leave	D. A. O. Chingleput.
,, Seshadri, C. R.	Superintendent, A. R. S. Tindivanam	Gazetted Superintendent A. R. S. Tindivanam.
,, Sankara Ayyar, M. A.	Superintendent, A. R. S. Palur,	Gazetted Superintendent A. R. S. Palur.
,, Subbiah Mudaliar, V. T.	On leave	S. L. A. Agricultural College, Bapatla.
,, Satyanarayanamurthi, M.	On leave	D. A. O. Ootacamund.
,, Subramania Mudaliar, V.K.	Regional Dy. D. A. Vellore,	HQ. Dy. D. A. Madras.
,, Venkatasaravayya Chetty	Superintendent, A. R. S. Samalkot	Gazetted Superintendent A. R. S. Samalkot.
,, Venkatasubramaniam, M. K.	Assistant Paddy Specialist A. R. S. Pattambi,	Gazetted Superintendent A. R. S. Tirurkuppam.
,, Venkataramana Reddi, T.	On leave	Lecturer in Botany, Agricultural College, Bapatla.

SUBORDINATE SERVICE.

APPOINTMENTS

Sri R. Alagarswami, B. Sc. Ag., is appointed as Agricultural Demonstrator, Paramakudi.

,, A. V. Krishnanandam, is appointed as Agricultural Demonstrator, Tiruvarur.

,, T. Suryanarayanamurthi, is appointed as Assistant in Millets, Coimbatore.

The following women graduates trained in Fruit Canning and preservation are appointed as women demonstrators and posted to the places noted against.

Miss. Leela Menon K. P., B. Sc., Madras,	Madras.
,, Leelavathi, P. G., B. A., Calicut	Coimbatore.
,, Evelyn Perianayakam, B. Sc., Mylapore,	Madras.
,, Shanta, C. K., B. Sc., Madras,	Cocanada.
,, Parvady Chinnapp, B. Sc., Ceylon.	Trichinopoly.

The following candidates are appointed as upper subordinates and are posted to the vacancies shown against each.

Sri Jagannathan, A.	A. D. Nugur.
,, Lakshmiah Ch.	A. D. Sugarcane Scheme Hospet.
,, Prabakara Rao, P.	A. D. Cuddapah.
,, Ramachandran, L.	A. D. Markapur.
,, Sanyasi Rao, C.	Assistant in Cotton, Hagari.
,, Venkatachari, B.	Assistant in Cotton, Hagari.

PROMOTIONS.

The following grade promotions of lower subordinates are ordered

Sri Achuthan Nair, E. — From Grade V to Grade IV from 1—7—47.
,, Cheriako, T. V. — From Grade IV to Grade II from 22—8—47.
,, Naganatha Ayyar T. R. — From Grade IV to Grade I from 23—8—47.
,, Ponniah, B. P. From Grade V to Grade IV from 1—4—47.
,, Rajaratnam, S. — From Grade IV to Grade II from 1—4—47.
,, Samu Iyar, P. V. — From Grade V to Grade IV from 20—5—47.

SUBORDINATE SERVICE.

POSTINGS AND TRANSFERS.

Name of Officers	From	To
Sri Adinarayanamurthi, S.	A. D., Tuni,	A. D., Nugur.
,, Alwa, K. S.	A. D., Karkala,	Agricultural Engineering Training, Coimbatore.
,, Appa Rao, K.	A. D., Nagur,	A. D., Chipurupalle.
,, Ananthachari, P. S	A. D., Mathuranthakam,	Plant Protection Assistant in (Entomology), Cuddalore.
,, Achuthan Nair, E.	Assistant F. M., Wynad,	Assistant A. D., Ponneri.
,, Bangarayya, M.	Assistant in Mycology, S. R. S., Anakapalle,	Assistant in Entomology, S. R. S., Anakapalle.
,, Dharmalingaswami, P.	F. M., A. R. S., Guntur,	A. D., Bellary.
,, Hanumantha Rao, D.	On leave,	Assistant in Plant physiology Agricultural College Bapatla.

Name of Officers	From	To
Sri James Colaco,	Botanical Assistant, Ootacamund,	Special A. D., Sugarcane Development work, Mangalore.
,, Kamalanathan, S.	Assistant in Cotton, Palur,	Cotton Assistant, Coimbatore.
,, Kuppuswami, S. V.	On leave,	Assistant in Chemistry, Coimbatore.
,, Krishnamurthi Rao, S.	P. A., to D. A. O., Bellary,	Special A. D., Adoni, Tungabadra Project.
,, Krishnaswami Ayyar, A.	A. D., Pattukottai,	P. A., to D. A. O., Pattukottai.
,, Krishnamurthi Rao, S.	A. D., Bellary,	P. A., to D. A. O., Bellary.
,, Kameswara Rao, G.	A. D., Kavili,	Special A. D., Sugarcane Scheme, Ramachandrapuram.
,, Krishnamurthi, I. V. G.	Assistant Millets Coimbatore,	Assistant in Millets Narasapatam,
,, Lakshmi Reddy, M.	Assistant in Cotton Hagari,	Agricultural Engineering Training, Coimbatore.
,, Lakshmipathi, S.	Teaching Assistant in Botany, Agricultural College, Bapatla,	Assistant in Mycology S. R. S. Anakapalle.
,, Lohidas, T.	Assistant in Mycology S. R. S. Anakapalle,	Teaching Assistant in Botany Agricultural College, Bapatla.
,, Nagarajan, V.	On leave,	A. D., Pattukottai.
,, Narayana Reddy, M. L.	On leave,	A. D., Seethampeta.
,, Narasimha Raju, K. A.	A. D., Narasapatam,	A. D., Krishnadeveipeta.
,, Narasimha Rao, G. L.	On leave,	F. M., A. R. S., Guntur.
,, Narayana N. G.	Assistant in Cotton Koilpatti,	Assistant in Cotton, Coimbatore.
,, Prasada Rao, E. V.	A. D., Krishna Deveipeta,	A. D., Narasapatam.
,, Muthuswami, N.	Assistant in Entomology,	Technical Assistant to Regional Food Commissioner, Madras.
,, Papayya, B. P.	A. D., Gummalakshipuram,	A. D., Tuni.
,, Prakasam, P.	On leave,	Assistant in Mycology S. R. S. Anakapalle.
,, Radhakrishnamurthi, S.	A. D., Cuddapah,	Agricultural Engineering Training, Coimbatore.
,, Ramalingeswara Rao, M.	Assistant in Oilseeds A. R. S., Tindivanam,	Marketing Assistant for the survey of oil-bearing Plants Madras.
,, Ramalingam, M.	A. D., Podili,	A. D., Kavili.
,, Sobhanadhiri, N.	On leave,	Teaching Assistant in Entomology Agricultural College Bapatla.
,, Satyanarayana, P.	On leave,	A. D., Darsi, (Nellore District).
,, Subramania Ayyar, R.	Assistant, A. D., Adirampatnam,	Assistant, A. D., Mannargudi.

Name of Officers	From	To
„ Subba Rao, P.	A. D., Chipurupalle,	A. D., Gummalakshipuram.
„ Sitarama Rao, K	Cotton Assistant, Co-Scheme,	Assistant in Cotton, Coimbatore.
„ Srinivasan, V.	A. D., Dindigul,	Agricultural Engineering Training Coimbatore.
„ Shanmughanainar, T. P.	A. D., Tanjore,	Agricultural Engineering Training Coimbatore.
„ Sriramulu, K.	A. D., Chandragiri,	A. D., Podili.
„ Venkatakusumba Rao, V.	On leave,	Plant Protection Assistant in Mycology, Bezwada.
„ Venkateswara Rao, P.	Plant Protection Assistant Mycology, Bezwada.	A. D., Kavali.
„ Venkata Rama Ayyar, S.	A. D., Mannargudi,	A. D., Mayavaram.
„ Venkataramana Rao, V. G.	A. D., Mayavaram,	Marketing Assistant for the survey of oil-bearing Plants Madras.
„ Vatisai Mohammad, S.	On leave,	Assistant in Oilseeds A. R. S, Tindivanam.
„ Venkataramiah, M.	F. M., A. R. S., Guntur,	A. D., Chandragiri.

Agricultural College and Research Institute Library, Lawley Road, P. O. Coimbatore

MONTHLY LIST OF ADDITIONS FOR MAY 1949

1. BROWN (William H.): Plant Kingdom — a text book of general Botany. 1935
2. DANBENMIRE (R. F.): Plants and Environment — A text of plant antecology 1947
3. Dutch Agriculture — Facts — (Netherlands — ministry of Agriculture and fisheries and food) 1948
4. ELEMENTS OF GENETICS — Mendals laws of Heredity with special application to man. 1947
5. FRASER (Allam): Sheep production. 1947
6. GOVERNMENT OF INDIA LABOUR BUREAU: — Ministry of Labour — Indian Labour — a Symposium. 1947
7. JOHNSTON (Katharine H): Vegetable culture — a study of growing of vegetable in open. 1943
8. Lyon (T. L.) and Buckman (H): Nature and properties of Soils—Edn. 4. Revised by H. O. Buckmam. 1948
9. LONG ISLAND — Catalogue and announcement of Agricultural and Technical Institute. Division of Industrial and related fields. 1949
10. SCHENDER: (P. J. V. D. H.) and Wright (F. B.) Horse on the farm (Union of S. Africa Dep. Agriculture Education and Research series No. 52). 1948
11. WATERSTOW (J. M.): Fungi of Bermada. 1947

The Madras Agricultural Journal

Vol. XXXVI JULY 1949 No. 7

CONTENTS.

TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high — and the Editorial Board will feel obliged if your articles are brief.

The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI July 1949 No. 7

Editorial

The Food Front: Within a period of two years India is to become entirely self-sufficient with regard to her food requirements and all food imports from abroad should cease by 1951. This is the objective set forth by the Prime Minister of India and he has appealed to the Nation to make serious efforts in this direction. While the problem of maintaining our food production to the level of our needs in relation to the rapidly growing population of the country is a large range problem and should be tackled as such, the immediate problem is what should be done here and now to make good the deficit of our basic requirements within the stipulated period of two years. A special organisation has been set up and a Commissioner of food production has been appointed to tackle the problem on an All-India basis. The highest priority is to be given to the food problem both in the centre and the provinces. Transport bottlenecks are to be removed and steps taken to increase the supply of fertilizers, seeds and implements. The activities of the various provinces and states are to be co-ordinated and adjustments made to avoid wastage, overlapping and duplication of effort. Sufficient funds will be placed at the disposal of the Food Commissioner to enable him to carry out the work entrusted to him. This organisation, it is hoped, with the active co-operation of the provinces and states and the people of this country will be able to make the country self-sufficient before the end of the year 1951.

But it is well to recognise that the task is not an easy one and correct planning and hard work lies ahead. If past experience be any guide, certain mistakes which resulted in wastage of huge sums of money on unfruitful ventures should be avoided. Particular care should be taken to see that new lands brought under the plough are cultivated with due regard to the suitability of the crop to be grown on them and also to the status of soil fertility. Except, perhaps, in the West coast the bulk of the uncultivated land in South India is

marginal land and only under extreme conditions like the present will it be worthwhile to cultivate them. With regard to the use of artificial fertilizers though we hold that they have an important part to play in increased food production, it is not to be forgotten that injudicious and unbalanced application of fertilizers will upset the biological equilibrium of the soil and may in the long run deplete the soil of its natural fertility which is an evil to be guarded against at all costs. Improved strains of crops do result in increased returns for a time. In recent times agrobiologists have recognized that improved strains 'run out' after a period and a recognition of this fact is necessary before distribution of any one particular strain is undertaken on a large scale and strains and varieties which have shown signs of decline should be eliminated and new strains substituted. We have thought it necessary to make mention of these facts in order to indicate the magnitude of the task involved so that people may not take a too complacent a view of the situation and take it for granted that somehow things will get adjusted by themselves. Conscious effort on the part of Government and people alike is necessary and the Prime Minister's appeal is meant to make us realise this. This brings us to the question of the part to be played by consumers in solving the food problem. The Prime Minister has appealed to the people to make less demand on rice as it would appear to be the costliest item in our food purchases from abroad. We recognize that it is difficult to change a food habit, but habits are formed and not inherent and a slight adjustment in the daily menu to meet a national emergency should not after all be difficult to a people interested in their country's welfare. Tapioca, sweet potato and plantain have been suggested as alternatives or supplements to a cereal diet. Tapioca, it may be mentioned in this connection, has been the mainstay of the people in the West coast where supplies of rice have been woefully inadequate during the last few years. We have to mention, however, that the vitamin content of these subsidiary foods is inferior to that of rice and steps should be taken to ensure a plentiful supply of vitamins to those who take to the changed diet. This can be done by the manufacture of food yeast on a large scale. The sugar factories which receive protectian to their industry may be asked to undertake this enterprise as a side line and sell the material at a low margin of profit.

An Introduction to the Study of Striga lutea (Lour) as a Root Parasite on Rice in Malabar*

By

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Except the references made in the Editorial note of the Agricultural Journal of India (1906) and by Palm and Heuser (1924) very little is known about the parasitism of Striga on rice. It may possibly be due to the fact that rice is grown essentially under swamp conditions where the parasite cannot thrive. There are however tracts that are infested with Striga lutea as in the Malabar Coast of Madras where rice is grown as a rainfed crop on the slopes of hills (*modan* lands) during the South-west monsoon between June and September.

In the district of Malabar, rice is cultivated mainly in three different classes of land. They are the swamp or the low-lying wet lands, the artificially terraced hill-slopes out-skirting a valley, popularly known as *Palliyal* and the dry hill slopes or the *modan* lands. In the first two classes of land there is flow of irrigation water, although in the latter, this is confined to a shorter period. For this reason, Striga does not occur in these types of land.

In Malabar there are particular areas where the parasite is known to occur year after year, so much so, that the ryots have been forced to give up cultivating rice on such lands. The seriousness of the pest was realised soon after the Agricultural Research Station at Pattambi was opened (Mad. Ag Stn. Reports, 1928-29). In certain of the fields where the parasite was occurring the crop in the affected and the adjacent non-infested areas was harvested separately and the figures given in the table below show the extent of damage that this parasite can inflict on the crop

Year	Variety	Grain yield per acre in the Striga infested area	Average yield per acre in the pest free area
1930—31	Budama	40 lb	500 lb
1934—35	Modan black glume	83 lb	409 lb
,,	Budama	25 lb	500 lb

The young plants when once attacked by this parasite, make little progress and gradually succumb.

* Part of a Thesis submitted for the M. Sc. Degree by the author.

Striga lutea (*Theepalli*—Malayalam) parasitic on rice plant at the Agricultural Research Station, Pattambi can be briefly described as an erect, branching, stiff herb of the Natural Order *Scrophulariaceæ* growing 6–15 inches high. Stem is slender, four-sided and hairy. Leaves are linear, very narrow, about half inch long, entire, sessile, arranged opposite below, and alternate opposite above. Flowers are many, white or yellowish, tubular with spreading limbs, epigynous, axillary and in the upper, either solitary or in lax bracteate spikes. Calyx is tubular and five-toothed. Tube is curved at the tip and the corolla four-lobed. Stamens are didynamous and epipetalous. Fruit is oblong, cylindric and one-fourth inch long.

Distribution of Striga lutea in Malabar with Special Reference to Walluvanad Taluq

Striga was known to be prevalent in a virulent form particularly in Ernad and Walluvanad taluqs, two out of the eight taluqs constituting the district of Malabar. A survey of this root parasite on rice was undertaken by the author in the *modan* areas of the Walluvanad taluq, wherein the Pattambi Agricultural Research Station is situated and the infestation was found to be universal though varying in intensity. In the Pattambi and Mannarghat firkas, two of the six firkas which go to make up this taluq, a fairly high degree of infestation was noticed. In very severe cases of attack the damage to the rice crop as judged by the eye on a comparison with the standing crop in the adjoining non-infested fields was estimated to be very considerable In some of the firkas like the Mankada and the Sreekrishnapuram the introduction of this pest appears to be comparatively of recent times It may be that *modan* cultivation in these areas was taken up only very lately. The existence even now in the surroundings of these *modan* lands of vast jungle areas fit for rice cultivation when cleared is in itself sufficient proof for this. The two firkas exhibiting the worst form of attack must have been the earliest to take the infection. It is generally noted that in a given area of *modan* cultivation, when Striga is detected in any odd corner, then necessarily the whole area is found infested. In a village, the rice cultivation is not, as a rule confined to a single consolidated area. Rice fields invariably are scattered in different localities separated from one another by garden lands, a barren hillock or a waste jungle. If Striga is noticed in any one field one could almost be sure that this could be traced, more or less, in all the other fields in that village. In the one case, the spreading of infection may mostly

be by wind disseminating the seed while in the other, it may be through the contaminated rice seed imported from the infected area. Facilities for cheap and easy transportation of seed largely available in recent years in the interior of the villages must mainly be responsible for such wide distribution of this pest. One thing however noted, has a special significance. It is seen that infection of Striga is very little, practically nil, among rice fields in the northern taluqs of Malabar as compared with her southern taluqs. In fact, as one proceeds from the far South towards the northern portions of Malabar, there is a gradual diminution in the infection, the most severe infection being confined to the *modan* lands in the southern end of Malabar. Hence it is reasonable to suppose that the original home of infection in Malabar is in the south and that this has gradually spread northwards.

In places of low infection met with in the Walluvanad taluq there is a risk of the infestation assuming alarming proportions unless serious attempts are made to exterminate this pest. Of a total area of 183,022 acres reported to be under the wet, *palliyal* and the dry cultivation in this Taluq during the year 1935—36, 101,239 acres were under the dry cultivation alone. It therefore becomes clear that, should this pest have such an unrestrained spread, there is no doubt that it will be a serious menace to the *modan* rice cultivation. It is a common sight to observe in the midst of *modan* rice fields infested with the parasite several patches either with little or no plants surviving or with plants, sickly and poorly developed, contributing practically nothing to the yield. These patches when closely examined reveal dense colonies of Striga. The affected host plants present a blighted appearance, a phenomenon characteristic of what is implied by the vernacular name given to the parasite.

Observations on the Incidence and the Morphology of Striga

Several of the minute striga plants when they are first observed emerging from the soil are found to possess well-developed non-pigmented underground stems. Observations recorded at this station have shown that the maximum height of a single mature plant measures 18·5 inches and possesses 15 pairs of well defined leaves and 14 pairs of capsules. The average height to which the Striga grows in the *modan* land could be set at 8 inches. In a colony of Striga, what appears to be independent plants above surface are sometimes only branches arising from a single stock. In a single plant there

may be as many as 60 branches and there may be as many as 200 plants in a single square foot of area. The underground stem is sometimes three or more inches long. As a rule, the underground stem does not extend below a two-inch-depth of the soil.

The general flowering under field conditions at the Agricultural Research Station, Pattambi has been observed to commence from the middle of July. Up to 15 pairs of capsules have been counted for a single plant. A single capsule on an average formed 600 seeds though it has been stated (Tadulingam & Narayana, 1932) that there may be as many as 50,000 seeds produced by a single plant. The seeds are very minute, avoid and striated and are held in the innumerable flaps or folds provided in the free central placenta. A seed measures on an average 313 $\mu \times 187 \mu$. The same authors have stated that the seed can remain viable for 40 years and more

For a Striga plant emerging from the top layer of the soil, it takes about two months from appearance above ground to the bursting of the last capsule borne by it. The period of life above ground may therefore, within limits, get appreciably modified according to the depth to which the seed remains stationed in the soil. This probably accounts for the flowering in Striga noticed to take place sometime after a week from emergence and in several other cases even before. Pearson (1913) in his studies on the underground growth and development of Striga assigned about seven weeks for the sub-terranean growth period of a particular Striga plant under observation. It is thus evident that besides other factors like soil moisture, the main condition that influences the life period of the Striga above ground is the depth at which the seed remains deposited. This does not mean that it is only the seeds that remain in the first few inches of the soil layer that give rise to the plants. Experiments have shown that seeds even in the deeper layers of the soil can germinate and produce plants. In a pot-culture experiment conducted by the author during the year 1935 a Striga seed was noticed to germinate even at 6 inches depth from the top surface. The young plant, however, could not push through the mass of soil on the top and did not develop beyond a certain stage. This therefore lends support to the view that only seeds within the top layer of the soil generally germinate and grow into overground plants and that the innumerable seeds lying within the confine of the sub-soil, if they germinate, produce young plants that are but short-lived. Such plants though they may not make much progress have to make use of the host plant for their existence and this

probably accounts for the sudden running down in condition of the rice plants in a Striga infected field though there may not be many Striga plants visible above the surface of the soil. For its metabolic activities the parasite Striga has to depend entirely upon its host when it is underground. When above ground, its dependence on the host is only partial as it makes its own plant food by photo-synthesis out of raw materials drawn from the host. Its development above ground, nevertheless, is mainly for its reproductive function.

Summary and Conclusions

Very little literature on the parasitism of Striga lutea on rice is available. A brief account of the main cultural practices of rice cultivation in Malabar is given to show their relation to the incidence of Striga. The seriousness of the menace of Striga on *modan* rice in Malabar is emphasized. A brief description of the parasite as it appears in the rice fields in Malabar is given. The whole of the Walluvanad taluq in the Malabar District of Madras is infested with the parasite S. lutea. There are evidences to indicate that the original home of infection with Striga in Malabar is in the far South and that this has gradually spread North. The observed variation in the time of flowering among the Striga plants may be due to the varying terms of life period spent by them below ground. The sudden running down in condition of the rice plants, when the visible Striga plants are only few, may be due to the parasitism by underground Striga. When underground Striga behaves as a total parasite, while above ground, it conducts itself as a partial parasite, its growth activity then being mainly directed towards its reproductive functions.

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Influence of Agronomic Factors on the Time of Flowering of Rice

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Introduction: *Flowering duration* of rice as defined in terms of the number of days that elapses from the date of sowing to the date of flowering, is an important varietal character though with wide variations; some of the cultivated rices mature within 50 days while the longest of them takes well over 150 days from sowing to flowering. It is observed that earliness and lateness constitute a pair of contrasting heritable characters, their behaviour in inheritance being simple or complex according to the genetic make-up of the parents involved. While this is true of the varieties native to a tract, instances are commonly found of varieties changing their duration when introduced into another tract with differing climatic conditions. Ramiah (1927) has recorded some outstanding examples of such changes in duration in the Province of Madras as also cases of constancy wherein the duration remains unaltered despite chanaes in climatic environment.

Within the same tract again, varieties fall under two important groups; the time-limited varieties which come to flower within a definite period irrespective of the season of sowing and season-limited varieties which flower only in a particular season of the year, their duration getting extended or reduced according as they are sown early or late. Even in a particular season in which a variety, whether season-limited or time-limited, is grown, changes in the time of flowering as well as in the period of flowering are noticed as a result of agronomic factors like time of sowing, age in the nursery, spacing given in the field, application of manures etc. This paper embodies some typical examples of such changes in the time and period of flowering recorded in the course of various field experiments (randomized replicated trials) conducted for over a decade at the Agricultural Research Station, Pattambi on the west-coast district of Malabar. *Time of flowering* herein refers to the date on which more than 75% of the plants in a population comes to flower and the *period of flowering* to the number of days that elapses between the commencement and completion of flowering in a given strip or clump of plants.

Varieties and Seasons: In the typical swamp soils of Malabar rice is cultivated in three seasons:— 1. First crop or the autumn rices grown from April — May to September — October. 2. Second crop or winter rices from September — October to December — January, and 3. Third crop or spring rices that are raised in limited areas with facilities for lift irrigation from February to May. The autumn rices are either broadcast or transplanted (major area being broadcast) while the winter and spring rices are as a rule transplanted. Monthly sowing trials with ten of the most popular varieties have indicated that the second-crop varieties and the long-duration first-crop varieties are season-limited while the short-duration first-crop varieties like PTB. 7, 8 and 9, tend to be time-limited along with the well-known cosmopolitan strain PTB. 10., which is pre-eminently time-limited and is generally raised in all the three seasons.

Experimental: *Broadcasting versus transplanting*: As indicated above, the autumn rices are sown broadcast with the early rains or sown with the early rains in a nursery and transplanted. Dates of flowering were observed in two series of experiments in one of which strain PTB. 1 with season-limited flowering was broadcast at three intervals and planted in one batch, the date of broadcast sowing being determined by the fall of adequate showers from April onwards. The second experiment comprised of one batch of sowing and one of transplanting with nursery sown on the same day of broadcasting, with strain PTB. 9. The experiments were conducted for three seasons. The results given in tables I and II indicate that even with a difference of 1 to 1½ months in the time of broadcast sowings, the flowering dates fall within a period of three weeks, the duration decreasing from an average of 140 days to 110 days. For the same dates of sowing the transplant crop flowered later than broadcast crop except in one season. This is confirmed in all the seasons in the second experiment where the transplant crop flowered 7 days, 6 days and 4 days later than the corresponding broadcast crop.

TABLE I

PTB. I. —Broadcast at intervals and transplanted

	Date of sowing		Time of flowering	Duration in days
1936—'37				
1. Broadcast	6—4—36		29—8—36	145
2. do.	15—5—36		4—9—36	112
3. do.	21—5—36		7—9—36	109
4. Transplant	15—5—36	(planted 17—6—36)	4—9—36	112

	Date of sowing		Time of flowering	Duartion in day
1937—'38				
1. Broadcast	27—4—37		30—8—37	126
2. do.	20—5—37		7—9—37	110
3. do.	28—5—37		14—9—37	109
4. Transplant	20—5—37	(planted 28—6—37)	11—9—37	114
1938—'39				
1. Broadcast	17—4—38		27—8—38	132
2. do.	26—4—38		29—8—38	125
3. do.	14—5—38		8—9—38	117
4. Transplant	26—4—38	(planted 9—6—38)	7—9—38	134

TABLE II

PTB. 9. —Broadcast and transplanted

	Date of sowing	Date of planting	Time of flowering	Duration in days
1942—'43				
1. Broadcast	27—4—42		11—8—42	106
2. Transplant	do.	17—6—42	18—8—42	113
1943—'44				
1. Broadcast	23—4—43		8—8—43	107
2. Transplant	do.	30—5—43	14—8—43	113
1944—'45				
1. Broadcast	7—5—44		17—8—44	102
2. Transplant	do.	14—6—44	21—8—44	106

(b) *Age of seedling*: Observations on flowering were continued in the experiments with different ages of seedlings for an ordinary transplant crop during first, second and third crop seasons.

In the first series of experiments three varieties were sown in three batches of sowings and all planted on the same day in the normal season. In the second series different ages of seedlings from 65 to 25 days were combined with different batches of plantings at intervals of 10 days. In the second crop season, the experiment was conducted for three seasons in two series, the first series was sown at intervals of 10 days and the seedlings planted on the same day and the second series sown on the same day was planted at intervals of 10 days. In the first, the age of seedlings gets reduced from 60 to 30 days by virtue of the difference in time of sowings while in the second series the age gets extended from 30 to 60 days as a result of delayed plantings. In the third crop season the time-limited variety PTB. 10 was sown on the same day and planted at intervals of 5 days, thus increasing the age in nursery from 15 to 55 days. As the flowering was found to be protracted in certain strips the period of flowering was also noted in this case. Experimental details and results are given in tables III to VI below.

TABLE III

Strains PTB. 1, 2 and 5 sown at different times and planted on the same day

	Date of sowing	Date of planting	Age in nursery in days	Time of flowering.	Duration in days
1945—'46					
PTB. 1.	4—4—45	15—6—45	72	3—9—45	152
	19—4—45	do.	57	6—9—45	140
	25—5—45	do.	21	9—9—45	107
PTB. 2.	4—4—45	do.	72	28—8—45	146
	19—4—45	do.	57	29—8—45	132
	25—5—45	do.	21	4—9—45	102
PTB. 5.	4—4—45	do.	72	31—8—45	149
	19—4—45	do.	57	2—9—45	136
	25—5—45	do.	21	7—9—45	105
1947—'48					
PTB. 1.	24—4—47	10—6—47	47	6—9—47	135
	8—5—47	do.	33	do.	121
	24—5—47	do.	17	10—9—47	103
PTB 2.	24—4—47	do.	47	27—8—47	175
	8—5—47	do.	33	29—8—47	113
	24—5—47	do.	17	4—9—47	103
PTB. 5	24—4—47	do.	47	1—9—47	130
	8—5—47	do.	33	5—9—47	120
	24—5—47	do.	17	8—9—47	107

Results are similar to those obtained in the case of broadcast sowings; irrespective of a long interval in the times of sowing the flowering dates fall close together.

TABLE IV

PTB. 2. —Different ages in 4 batches of plantings

Date of sowing	Time of flowering	Age in days	Duration in days	Time of sowing	Time of flowering	Age in days	Duration in days
	I. planting 10—6—'47				**II. planting 20—6—'47**		
25—4—47	25—8—47	45	122	25—4—47	30—8—47	55	127
5—5—47	do.	35	112	5—5—47	1—9—47	45	119
15—5—47	30—8—47	25	107	15—5—47	2—9—47	35	110
25—5—47	*	*	*	25—5—47	8—9—47	25	106
	III. planting 30—6—'47				**IV. planting 10—7—'47**		
25—4—47	30—8—47	65	127	*	*	*	*
5—5—47	do.	55	117	5—5—47	6—9—47	65	124
15—5—47	1—9—47	45	109	15—5—47	8—9—47	55	116
25—5—47	9—9—47	35	107	25—5—47	9—9—47	45	107

* Seedlings over 65 days and under 25 days were not planted.

For the same date of planting the duration gets reduced with decreasing age in the nursery and for the same age it gets reduced with delayed plantings. In the second batch of planting for instance, the flowering duration gets reduced from 127 days to 106 days; for an age of 45 days, the duration of 122 days in the first planting falls to 107 days in the fourth batch of planting.

As regards time of flowering, it is delayed for the same date of planting as the age in nursery gets reduced and is also delayed with advancing season with a difference of 15 days in flowering for a delay of 30 days in the time of planting.

TABLE V.

Second crop PTB. 3 sown and planted at 10 days intervals

	Date of sowing	Date of planting	Age in days	Time of flowering	Duration in days
1935—36	10—8—35	9—10—35	60	24—12—35	136
	20—8—35	do.	50	do.	126
	30—8—35	do.	40	do.	116
	9—9—35	do.	30	do.	106
	do.	19—10—35	40	20—12—35	102
	do.	29—10—35	50	24—12—35	106
	do.	8—11—35	60	26—12—35	108
1936—37	12—8—36	12—10—36	60	8—12—36	118
	22—8—36	do.	50	do.	108
	1—9—36	do.	40	13—12—36	103
	11—9—36	do.	30	14—12—36	94
	do.	22—10—36	40	21—12—36	101
	do.	1—11—36	50	24—12—36	104
1937—38	11—8—37	10—10—37	60	10—12—37	121
	21—8—37	do.	50	9—12—37	110
	31—8—37	do.	40	10—12—37	101
	10—9—37	do.	30	do.	91
	do.	20—10—37	40	17—12—37	98
	do.	30—10—37	50	23—12—37	104
	do.	9—11—37	60	27—12—37	108

The results show that, provided the planting is done in the season, for the same date of planting, even a difference of 30 days in the age of the seedling does not materially affect the time of flowering, all the lots coming to flower on the same date, while delayed plantings delay the time of flowering. Here, in the second-crop season, the age in nursery has far less effect on the time of flowering than in the first-crop season.

TABLE VI

Third crop—PTB. 10. sown on the same day and planted at intervals.

Date of sowing	Date of planting	Age in days	Time of flowering	Duration in days	Period of flowering
29—1—40	13—2—40	15	10—4—40	72	5
do.	18—2—40	20	10—4—40	72	7
do.	23—2—40	25	12—4—40	74	9
do.	28—2—40	30	19—4—40	81	9
do.	4—3—40	35	20—4—40	82	15
do.	9—3—40	40	20—4—40	82	15
do.	14—3—40	45	20—4—40	82	16
do.	19—3—40	50	22—4—40	84	17
do.	24—3—40	55	22—4—40	84	17

For this variety in the third-crop season, an age of 20 to 25 days in the nursery is the optimum. Beyond that the flowering gets shifted by about a week and remains more or less steady within the age group 30 to 55 days. Here however, the flowering is observed to be protracted, the period of flowering extending to 17 days in the case of seedlings aged 50 to 55 days.

(c) Spacing: A number of experiments were conducted at the Agricultural Research Station, Pattambi, as elsewhere in the Province of Madras, giving different spacings to rice seedlings at planting and the data published hitherto refer exclusively to the influence of spacing on the yield. In the course of a series of such experiments it was noticed every year and in every season that the time of flowering was also changed as a result of spacing. Close-spaced plots were inclined to be early and uniform, whereas as spacing was increased the trend was towards delay in the time of flowering. Typical examples of such changes in time of flowering are given below for first and second-crop seasons. In one experiment different spacings from 3" x 3" to 12" x 15" were adopted, keeping the number of seedlings per hole constant. In the second series the spacings were increased from 3" x 3" to 12" x 12" and the number of seedlings in each hole is also increased from 1 to 4.

In these experiments it was also noted that the most vigorous seedling in a bunch of seedlings flowered first while others took more time and the tillers they produced subsequently still more time to flower, the tillering and consequent protraction in flowering being induced by wide spacings between the clumps. In order to study in detail the sequence of flowering, six clumps were marked out at random

in the experimental sub-plots in one of the experiments during first and second crop seasons and the average interval between the time of flowering of the first and the last tiller in the clump (period of flowering) noted. Results are given in the tables below :

TABLE VII

Different spacing with number of seedlings per hole constant

First Crop—PTB. 9 Second Crop—PTB. 3

Spacing	Number of Seedlings	Time of flowering	Duration in days	Period of flowering	Time of flowering	Duration in days	Period of flowering
3 x 3 inches	2	26—8—39	111	3	14—12—39	97	2
3 x 6 ,,	2	27—8—39	112	8	15—12—39	98	8
6 x 6 ,,	2	29—8—39	114	8	16—12—39	99	10
6 x 9 ,,	2	30—8—39	115	10	17—12—39	100	17
6 x 12 ,,	2	29—8—39	114	11	...	100	18
12 x 9 ,,	2	1—9—39	117	12	19—12—39	102	21
12 x 12 ,,	2	2—9—39	118	13	22—12—39	105	26
12 x 15 ,,	2	3—9—39	119	14	24—12—39	107	28

TABLE VIII

Different spacing with varying number of seedlings

First crop—PTB. 5. Second crop—PTB. 4.

Spacing	Number of seedlings	Time of flowerings	Duration in days	Time of flowering	Duration in days
3 x 3 inches	1	10—9—43	130	27—12—42	111
...	2	...	130	25—12—42	109
...	3	...	130	...	109
...	4	9—9—43	129	24—12—42	108
4 x 4 ,,	1	12—9—43	132	28—12—42	112
...	2	...	132	27—12—42	111
...	3	9—9—43	129	25—12—42	109
...	4	8—9—43	128	26—12—42	110
6 x 6 ,,	1	12—9—43	132	1— 1—43	116
...	2	...	132	28—12—42	112
...	3	11—9—43	131	27—12—42	111
...	4	10—9—43	130	...	111
8 x 8 ,,	1	13—9—40	133	3—1—43	118
...	2	13—9—43	133	1— 1—43	116
...	3	12—9—43	132	29—12—42	113
...	4	10—9—43	130	...	113
12 x 12 ,,	1	14—9—43	134	7—1—43	122
...	2	14—9—43	134	4—1—43	119
...	3	12—9—43	132	2—1—43	117
...	4	12—9—43	132	...	117

The foregoing results would show that the flowering time tends to get delayed as the spacing is increased and that the delay is less when the number of seedlings per hole is increased. The period also gets lengthened as the spacing is increased and the differences in both time and period of flowering between different spacings are more distinct in the second-crop season than in the first-crop season. It must be mentioned here that the date of flowering in bunch planting denotes the date on which the more vigorous seedling in more than 75% of bunches in the sub-plot came to flower and not the date of flowering of all the seedlings in the individual bunches.

(d) Manures: It is common observation that heavy dressing of manures delay the time of flowering in most of the varieties but ordinarily the shift in time is not more than two or three days at the most. Marked deviation however, in the time of flowering was noticed in the manurial experiments with wood ash when it was applied to transplant fields at the fairly high rate of 4,000 lb. per acre either alone or in combination with other manures like green leaf, groundnut cake etc. Experimental details and results are given below :

TABLE IX

Treatments :

1. No manure (Control)
2. Wood ash at 4000 lb. per acre.
3. Wood ash at 4000 lb. plus leaf at 4000 lb. per acre.
4. Leaf at 4000 lb. per acre.
5. Wood ash at 4000 lb. plus groundnut cake at 4000 lb. per acre
6. Groundnut cake 400 lb per acre.

First crop—PTB. 14. Second crop—PTB. 4.

Year	Treatments	Time of flowering	Duration in days	Time of flowering	Duration in days
1943—44	1	25—8—43	116	2—1—44	127
	2	20—8—43	111	31—12—43	125
	3	21—8—43	112	1—1—44	126
	4	24—8—43	115	1—1—44	126
	5	20—8—43	111	31—12—43	125
	6	25—8—43	116	...	125
1944—45	1	25—8—44	99	19—12—44	111
	2	21—8—44	95	19—12—44	111
	3	21—8—44	95	19—12—44	111
	4	23—8—44	97	19—12—44	111
	5	21—8—44	95	20—12—44	112
	6	24—8—44	98	20—12—44	112

The time of flowering in the first-crop season is advanced by about a week by the application of wood ash at 4,000 lb. per acre alone or in combination with leaf or cake, while it has very little effect during the second-crop season.

4. **Discussion**: From the periodical broadcasting experiments it is seen that the flowering is delayed as sowing is delayed but the shift in time of flowering is not in direct proportion to the length of sowing intervals. For a difference of 30 days in the dates of sowing, for instance, the corresponding difference in flowering is 15 days or less. This would show that up to a particular period within the season, weather favours vegetative growth while in the later stages it is predominantly conducive to flowering. For the same date of sowing for the broadcast and transplant series, flowering is found to be delayed in transplant crop (vide Table I and II). Only in one out of six seasons of trial have the transplant and the broadcast crops flowered on the same date. These results are at variance with those obtained in Coimbatore where, the flowering of the transplant crop was found to be sharp and uniform while in the broadcast crop it was uneven and delayed (Ramiah and Hanumantha Rao, 1936.)

It is also found that the flowering was not affected if planting was done on the same date in the season whatever the age in the nursery, but in delayed plantings the earlier the planting the earlier was the flowering. These results are more or less similar to those obtained in the experiments conducted at Coimbatore (Ramiah, K. 1936). In the first-crop season, however the flowering is also found to be delayed with decreasing age in the nursery i. e., the older the seedlings the earlier was the flowering. It may be mentioned that both in the first and second-crop seasons, the crop yield suffers if planting is delayed irrespective of the growth of seedlings, the time of planting having a greater influence in maintaining yields than age in nursery. In the light of the above findings, the *duration* generally specified for a variety should be considered as the *minimum period of time* required for it to give its natural yield within a particular season.

Of all the agronomic factors spacing is found to have the maximum effect on the time of flowering. It is delayed as the spacing is increased and in wider spacing it is possible to check the delay if the number of seedlings per hole is also correspondingly increased. Ramiah has observed that when extra spacing between plants was given the *period* between which the flowerings commenced and finished as much as three weeks. This *period* which in the

above experiments had gone up to four weeks, could be reduced only to a limited extent by increasing the number of seedlings per hole. It is found that the age of seedlings also affects the period of flowering (vide Tables VI and VII). There are rices which have an inherently protracted period of flowering (long period) and from the agronomic point of view the variety that starts and finishes flowering in a minimum period (short period) is always to be preferred. (Ramiah 1927). Pattambi strains PTB. 15 and 16 are typical examples of the former while all the rest of the strains belong to the short period group. Protracted flowering is found to be characteristic of some varieties and is probably a heritable feature. While it is possible to induce this long-period nature in otherwise short-period varieties by nature in this case by wide spacing of plants, close planting in bunches is ineffective in bringing about sharp flowering in 'long period' varieties. A study therefore, of the 'short period' flowering in 'long period' varieties would prove very useful as also varietal studies with special reference to the inheritance of this character.

While heavy dressing of most of the manures tend, if at all, to shift the flowering towards lateness, wood ash at 4000 lb. per acre (100 lb. K_2O) was found to hasten it by four to five days in the first-crop season. No such effect was noticed in the second-crop season. In previous experiments also, wood ash at 1000, 2000 and 3000 lb. per acre did not show any marked difference in flowering nor did potassium sulphate to supply 60 lb. K_2O per acre. Whether the effect on flowering is due to potash and if so its ceiling dose beyond which flowering gets shifted can be assessed only after further trials with wood ash and potassium sulphate at high incremental doses.

5. Summary

1. The effect of different agronomic influences on flowering in rice was studied for a number of seasons.
2. In broadcast sowing at different intervals, flowering is delayed with delayed sowing; the dates of flowering fall at shorter intervals than the dates of sowing. These narrow shifts in time of flowering are attributed to the later weather conditions which are more favourable to flowering.
3. For the same dates of sowing, for broadcast and transplant crop flowering in transplant plots tends to be delayed, unlike the results obtained at Coimbatore.

4. In delayed plantings, with different ages of seedlings the earlier the planting the earlier was the flowering; in the first-crop season it was earlier with older seedlings as well.
5. Spacing is found to have the maximum effect in changing the time of flowering as also the period, the time approaching that of close planting to a limited extent with increase in the number of seedlings.
6. Wood ash at the fairly high rate of 4,000 lb. per acre is found to hasten flowering by about a week in the first-crop season while it has no effect in the second-crop season.
7. The need for further experiments is pointed out and future line of work suggested as regards inheritance studies with reference to flowering habit as also regarding the influence of potash on the time of flowering of rice.

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A Note on Pre-Soaking in Phosphate Solutions for Increasing Yield in Rice

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In recent years research is being directed towards a more efficient utilisation of fertilizers for inrceasing crop production. Various methods of applying fertilizers, differing from straight placement, but with the same object in view, of making available a larger quantity of nutrient elements to the growing plant have been tried. The literature on this aspect of fertilizer research has been very ably summarised in Soils & Fertilizers, Vol. 10, (1947). Among these various methods, coating the seeds with fertilizers before sowing is one and Gusev (1940) has claimed that, by treating cereal and other seeds with phosphates before sowing, either by moistening with a solution of phosphate fertilizer or by coating with a mixture of starch paste and fertilizer, the plants were able to utilise as much 70–80 per cent of the phosphate supplied. The possibilities of this method of pre-soaking seed in nutrient solutions, both as a means of supplying major elements like phosphorus and potassium and as a means of rectifying trace-element deficiencies have been explored in England by Roach and Roberts (1949). The most important result was observed in the case of oats, by soaking it in about one-third of its weight of 21 per cent tri-basic potassium phosphate solution and sowing the seed in phosphate-deficient soil. The yield from untreated seed was 17 bushels per acre, from water-soaked 20, and from phosphate-soaked seed. 25 bushels to the acre, with correspondingly large increases in straw. Similar large increases in yield were recorded in the case of other cereals, like wheat and barley, though the optimum concentration of the phosphate solutions were different. It was observed that the phosphate imbibed by the seed was deposited mainly in the husk, from where it could easily be washed off by running water. A similar promising result was also found in an experiment on oats grown in a manganese-deficient soil suggesting that a large part of the *Mn* requirement in oats could be provided by soaking the seed before sowing, in suitable dilutions of manganese salts.

In view of the obvious convenience, cheapness and adaptability of this technique of pre-soaking and since the method, if substantiated on other crops in large-scale field trials would be of very great practical value for Indian conditions, certain preliminary studies were started at Coimbatore on paddy, groundnut and cowpea, in pot-cultures to see how far the growth and yields of these crops could be improved by using the pre-soaking technique. The results that are available in the case of paddy appear to be of sufficient interest to merit publication for the information of other workers elsewhere who might be contemplating similar trials.

Material and Methods

A short-duration paddy variety Co. 13 was chosen as suitable for sowing in February. A number of treatments, using two concentrations, 10 and 20%, of three kinds of potassium phosphate were tried in addition to soaking in mere distilled water. Incidentally an attempt was also made to see how for pre-soaking in different strengths of a growth-promoting hormone, beta-indolyl-acetic acid, would affect the growth and yields as compared to soaking in phosphate solutions. The seeds were soaked in a third of their weight of solution, care being taken to see that all the liquid was absorbed by the seed within 24 hours. The seed was then air-dried to its original weight, by spreading it thin in a wide stray, with occasional turnings to ensure uniform drying. The seeds were sown in 10″ x 10′ glazed pots holding about 30 pounds of soil, at the rate of two per hole and twentyfive holes per pot. After germination the plants were thinned out in three stages before flowering so as to have a uniform stand of ten plants per pot for flowering and yield records. When ripe the plants in each pot were harvested, separated into grain and straw and weighed, once to get the fresh weight and again after complete drying, to secure dry weight records. The material thus gathered is being utilised for chemical analysis to see if any difference exists in the phosphate or potash content of plants from treated and control seed

The results so far as they relate to growth and yield in paddy are summarised in the table attached.

It would be clear from the data that pre-soaking the seed in tri-basic potassium phosphate has resulted in a better growth than soaking in solutions of the other two salts, mono-basic and di-basic potassium phosphates. With tribasic phosphate itself, a higher

strength seems to be more helpful than a lower one. The grain yield in treatment 8, (soaking in 20% tribasic phosphate solution) is nearly 40 per cent more than in control, while it is only 21% more in the case of treatment 7, (soaking in 10% solution.) Pre-soaking in beta-indolyl acetic acid has also improved the grain yield significantly, but there is no great difference in effect between ten and twenty parts per million concentrations. Pre-soaking in mere distilled water has had no effect on grain yield if done once (treatment 1), but a repetition of the process (treatment 2) has a definitely adverse effect on both grain and straw. A combination of presoaking in phosphate solution and vernalisation in continuous light for two weeks (treatment 13) did not show any beneficial effect on grain or straw yield, although the tillering appeared to be improved. Further work is needed for determining the factors involved in this mutual annulling effect of two methods, each of which is individually beneficial in improving yields

In regard to plant height, soaking in tri-basic phosphate has produced the tallest plants, with the 20% treatment better than 10%, but this is counter-balanced by a poorer tillering in the former so that the straw yield in treatment 8, is less than in treatment 7. Straw yields in general do not seem to be improved much by any of the phosphate soakings ; nor is there any perceptible effect in flowering earliness.

Summary

The results obtained from a preliminary pot-culture study on the effect of pre-soaking paddy seed in phosphate solutions are presented and discussed. Soaking the seed in a 20 percent solution of tri-basic potassium phosphate showed an increase of 38·8% in grain yield over control and a 21·1% increase after soaking in a 10% solution.

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TABLE

Effect of Pre-soaking Paddy Seed in Phosphate solutions

Pot-Culture Experiment in 10" x 10" glazed pots ... Variety—Co. 13
13 Treatments, replicated 4 times, each in 2 soils ... Sown on 28—2—1949.
Complete, (NPK) and phosphate-deficient, (NK) ... Flowered — May, 1949.
From the Permanent Manurial plots ... Harvested — 8—6—1949

(a) Summary of Results, from both soils types, NPK and NK

No.	Treatments	GRAIN YIELD. Mean per pot (gms.)	% on Control 100	STRAW YIELD. Mean per pot (gms.)	% on Control 100	Plant Height (gms.)	Tillering	Flowering (days)
1	Soaked—and dried in 1/3 weight of seed of distilled water—once	21·35	94·5%	37·39	70·2%	98·1	2·9	76
2	,, —thrice	17·50	77·5%	33·00	63·6%	94·6	2·8	79
3	,, KH_2PO_4 — 10%	21·35	94·5%	45·50	84·7%	99·2	3·4	77
4	,, ,, 20%	20·88	92·4%	58·44	112·7%	101·1	3·5	77
5	,, K_2HPO_4 — 10%	22·10	97·8%	51·25	98·8%	104·5	3·2	80
6	,, ,, — 20%	25·06	110·9%	48·63	93·8%	103·0	2·8	77
7	,, K_3PO_4 — 10%	27·36 *	121·1%	57·26	110·4%	106·0	3·3	77
8	,, ,, — 20%	31·35	138·8%**	52·58	101·4%	109·5**	3·0	76
9	,, beta—indole acetic acid 10 p.p.m.	26·86 *	118·9%	45·78	88·3%	102·1	3·0	74
10	,, 20 p.p.m.	26·50 *	117·3%	51·12	98·6%	104·3	3·4	74
11	**Control** — dry seed	22·59	100·0%	51·86	100·0%	98·8	3·6	77
12	Soaked 24 hours before sowing	21·00	93·0%	52·74	101·7%	101·3	3 0	76
13	Continuous light for 14 days, in conjuction with soaking in 2% K_3PO_4 solution	19·34	85·6%	51·89	100·1%	94·9	4·6	78
	Whether statistically significant or not	Very	highly	significant		Yes	Yes	No
	Critical difference — 1% level	5·27 gms.	23·3%	11·67 gms.	22·5%	81 cm.	0·6	
	,, 5% level	3·20 gms.	14·2%					

(b) Effect of Soil

	Grain yield	Straw yield	Plant Height	Tillering	Flowering
Complete (NPK) soil	25·78 gms.	54·02 gms.	100·3 cm.	3·6	76·5 days
P-deficient (NK) soil	20·87 ,,	43·98 ,,	102·3 cm.	2·7	77·4 days
Whether significant or not	Yes	Yes	Yes	Yes	No
Critical difference 1% level	2·07 gms.	4·58 gms.	3·2 cm.	0·2	

Note:—* Superior to control at 5% level.
** ,, at 1% level.

Turmeric Cultivation

By

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Introduction: Turmeric is one of the important commercial crops in Madras Province cultivated for the underground rhizomes. The cured rhizomes commonly known as turmeric is used for culinary purposes in Indian house-holds. It is also used for toilet purposes by Hindu women in South India, more particularly in Andhra-Desa. It is exported to foreign countries to some extent for the manufacture of dyes. Turmeric is an exhausting crop and responds very well to manuring and irrigation. Under ideal soil conditions and intensive cultivation, it is a highly remunerative crop. It comes up well in rich loamy soils that are friable and have a good natural drainage. Turmeric cultivation is therefore confined to certain favoured localities, where the cultivation of the crop, the processing of the rhizomes and marketing tend to get specialised.

Distribution: Turmeric is grown in Malabar, Guntur, Krishna, Cuddapah and Coimbatore Districts. The area under this crop in other districts is negligible.

Acreage as Per Season and Crop report 1946 — '47.

Districts	*Acres*
Malabar	7,105
Guntur	7,686
Krishna	2,976
Cuddapah	2,739
Coimbatore	2,262
All other districts	4,999
Total ...	27,767

In the three districts where the survey was conducted, the cultivation of the crop is restricted to a few taluks, as shown below :—

Guntur District	*Acres*
Tenali taluk	4,474
Guntur taluk	2,771
Repalli Taluk	321
Krishna District	*Acres*
Bezwada taluk	1,646
Gannavaram taluk	1,000
Divi taluk	188

Cuddapah District			*Acres*
Proddatur taluk ...	...	...	961
Cuddapah taluk ...	...	...	638
Sidhout ...	...	...	485
Rajampet ...	...	...	376

Soils: Turmeric is grown generally in the black clay loams called "Regada" lands in the districts surveyed, excepting in parts of Cuddapah. In Rajampet, Cuddapah and Proddatur taluks, turmeric soils are light black or grey in colour, and they are called "Tuvva" lands. Turmeric is also grown in red soils in the Kodur tract of Cuddapah district. Turmeric crop is raised in wet lands that are in a high level, from which water could be drained during the rainy months. In a few places turmeric is also grown in dry lands having good irrigation facilities.

Rotation: The crop is largely cultivated in high level wetlands where it is rotated with other wetland crops such as paddy, sugarcane, plantain, yam, dioscorea, betel-vine and vegetables. In garden lands, it is rotated with other dry and garden land crops such as dry paddy, maize, redgram, gogu, gingelly, ragi, korra and sajja. A two or three-course rotation is the general practice depending upon the size of the holding. However, the ryots believe that the longer the interval between successive crops of turmeric, the better it would be for the soil and for the crop.

The following are the rotations followed in general:

Wet lands

(1)	I. Crop	...	Turmeric.
	II. Crop	...	Paddy followed by a pulse.
	III. Crop	...	Plantain, sugarcane, root crops, vegetables, or betel-vine.
	VI. Crop	...	Turmeric, or Ratoon crops of sugarcane, plantain or betel-vine.

Garden lands

(2)	I. Crop	...	Turmeric.
	II. Crop	...	Redgram mixed with dry paddy, maize or groundnut.
	III. Crop	...	Turmeric.
(3)	I. Crop	...	Turmeric.
	II. Crop	...	Early gingelly followed by horse-gram, or a fodder crop.
	III. Crop	...	Redgram mixed with dry paddy, gogu or maize.
	IV. Crop	...	Turmeric.

*(4) I.	Crop	...	Turmeric.			
II.	Crop	...	Ragi,	Korra,	Sajja, or	paddy.
III.	Crop	...	do	do	do	do
IV.	Turmeric.					

*NOTE: *This rotation is followed in Rajampet taluk and all the crops are irrigated.*

Mixtures: Turmeric is grown only as a pure crop as a rule as mixing it with any other crop is said to reduce the yield of turmeric. However, castor and vegetables may be seen as a light mixture here and there, intended mainly for houeshold purposes.

Cultivation: (1) *General*: Methods of cultivation are more and less the same in Guntur and Krishna districts. The furnace, the curing appliances and method of curing in Guntur District especially in Duggirala area, are somewhat modernized. Cultivation in Cuddapah is slighty different especially in respect of after-cultivation, harvest and curing. In Guntur and Krishna the spacing is 18 inches and inter-spaces are ploughed after the crop is on. The crop is harvested with the aid of the country plough. Curing is done in a water-bath, holding 4 cubical troughs filled with rhizomes. The troughs have perforations on the sides, so that when removed from the bath, the water is drained into the water bath. At Cuddapah the spacing is 12 inches between the rows and it does not permit of interploughing and so hand-weeding is resorted to. The crop is lifted with pick-axes. The furnace is too big, consuming large quantities of fuel and the pan is similar to a jaggery boiling pan. The curing methods of Guntur might possibly be introduced in Cuddapah. The average yields, and the quality of the produce are almost the same in all these districts ranging from 10 to 12 candies per acre. The yields appear to be the highest in the Kodur area. The area under turmeric in individual holdings no doubt varies widely, but on an average it is half to one acre per holding. In a few villages in Tenali and Gannavaram taluks, some ryots cultivate from 10 to 20 acres, at the same time maintaining the normal intensity of cultivation.

(2) *Preparatory Cultivation*: Preparation of the land varies widely from tract to tract, the minimum being two ploughings in Mydukur area of Cuddapah district to 16 ploughings in Rajampet arer of the same district. In Guntur and Krishna 4 to 10 ploughings are given, the average being seven. The land is ploughed with the country-plough, commencing from the harvest of the previous crop or from the commencement of early rains. In the former case the period of preparation extends over 5 to 6 months and in the latter over 1½ to 2 months.

(3) *Manuring*: The crop is very heavily manured and all available manurial resources are tapped to the full.

(i) *Green Manuring*: Green manuring is believed to be advantageous for the crop but is not followed regularly, due to limitations in raising green manure crops during the fallow period. In Reppalli taluk of Guntur district green gram is sometimes raised and ploughed in as green manure with good results.

(ii) *Application of clay and silt*: Carting top soil from wet lands is largely followed in Guntur and Krishna districts. 30 to 100 cart loads per acre are applied. In Cuddapah district silt from tanks and canals is carted wherever possible.

(iii) *Cattle penning*: Cattle penning is a regular practice throughout Guntur and Krishna. This is done during summer from March till June using their own cattle. It works out to 800 to 1000 per acre. This practice is unknown in Cuddapah district.

(iv) *Cattle manure*: Cattle manure is invariably applied in all the places and heavy doses ranging from 20 to 50 carts (each cart-weighting about half a ton) are given. The cost of a cartload of cattle manure is Rs. 3/- to 4/- in the Circars and Rs. 5/- to 6/- in the Cuddapah district.

(v) *Sheep-penning*: Sheep-penning is also extensively adopted in all these districts. 2,000 to 4,000 sheep are penned per acre, costing about Rs 12—8—0 per 1,000 sheep.

The following would represent in general, the quantity of manure an acre would receive.

	Guntur & Krishna	*Cuddapah*
1. Clay or silt	30 cart loads	50 cartloads
2. Cattle-penning	800 head loads	...
3. Sheep-penning	2,000 per acre	3,000 per acre
4. Cattle-manure	50 cartloads	50 cart loads.

(b) *Top dressing*: Generally groundnut cake is used as a top dressing, at an average rate of 8 bags per acre in two equal doses in September and October with an interval of 1 to 1½ months in between. The cake is powdered and applied along the lines near the base of the plants. Broadcasting the cake over the field and applying it to individual plants are also done, but line application is more common. In Guntur and Krishna the top dressing is followed by ploughing the interspaces for incorporation of the manure. In Cuddapah it is done by hand-weeding and hoeing. In this district leaf-mulching is a common practice. Due to the nearness of forests, leaf is available in plenty, free of cost. Soon after planting, about 20 cartloads of leaf are evenly spread over the surface of an acre. By the time the germination is completed (in about 40 days), the

leaves decay and are littered over the surface. The twigs are then easily shaken and removed. The leaf would gradually gets mixed up with the soil during the weeding operations. This practice is followed in Kodur, Rajampet and Prodatur tracts.

(4) *Planting*: Planting season commences from first week of June and continues up to first week of August. Early planting commencing from June (***Mrigasira***) is favoured in Cuddapah. In Guntur, the main season is July (*Arudra and Punarvasu*) and in Krishna, it is in early August (***Aslesha***).

Mother rhizomes which are round are used throughout Guntur and Krishna districts as seed material. They are cut into two pieces longitudinally each having one round bud. Fingers are used in Cuddapah without cutting, the long pieces being merely broken into two before planting.

The seed rhizomes are dibbled behind the country plough and covered by the next furrow slice. In Guntur and Krishna the spacing is 18″ between rows and 9″ between plants in the rows. In Cuddapah the spacing is 12″ and 6″ respectively. The depth of sowing is about 3″. The seed rate ranges from 4 candies in Guntur and Krishna to 5 candies in Cuddapah. In Cuddapah tract the land is levelled with a levelling board after planting and laid out in beds and channels with a country plough. The size of beds is about 10 x 6 feet. The seed material which comes up during the layout is pressed into the soil during the time of rectification of beds and channels. In Guntur and Krishna, ridges and furrows are formed with the country plough at planting time and rectified later by interploughing during the period of crop growth.

(5) *After cultivation*: Four and weedings are given commencing from a month after planting at intervals of 1 to 1½ months. Total labour required for this operation is about 100 women per acre. The interspaces are also ploughed four times in Krishna and Guntur districts.

(6) *Irrigation*: Major area is under flow irrigation chiefly from canals and to some extent from tanks. In some places where the level of the land is high, swing baskets are used for lifting water, from irrigation channels. Throughout the Kodur area, water is lifted from wells by double mhotes. In parts of Guntur, Bezawada and Gannavaram taluks, lift irrigation by mhotes is common. In some villages of Bezwada taluk electric motors are used for lifting water. Irrigation are given as and when necessary. The total number of irrigations varies with the retentivity of the soils. The total number of irrigations given to the crop is 12 in Guntur and Krishna districts, 16 in Kodur and 20 in Rajampet, Cuddapah and Prodatur tracts. When water is taken from canals or tanks, water rate is charged as for double cropped paddy lands.

(7) *Harvest*: March to April is the main harvest season. Drying of the leaves and stem is the sign of maturity. Dried stems and leaves are picked and reserved for use as fuel. A country plough is worked carefully just by the side of the rows. The rhizomes are neatly lifted and thrown to a side without injury. Women coolies pick the rhizomes. One pair can lift rhizomes from an acre in a day, 50 women can pick and gather the rhizomes, and 10 women can separate the rounds and fingers. This is the practice in Krishna and Guntur. In Cuddapah, lifting is done using a tool called "*Karu*" or "*Pasupu Karu*" resembling a pick axe. 15 men are required per acre for digging the outcrop with this tool. Fresh rhizomes from one plant weight from one to three lbs., the maximum weight being about 6 lbs. The average number of fingers produced per plant is about 10, the maximum being about 40.

(8) *Curing*: Curing is taken up soon after harvest, normally within 4 or 5 days. The rhizomes are boiled in water till frothing takes place and white fumes appear, emitting a characteristic odour when the rhizomes are removed and dried. The stage at which the rhizomes are removed influences the colour and fragrance of the produce. Experienced curers are therefore engaged for this purpose. The furnace resembles the Sindewahi furnace except for the square sides and the absence of the baffle wall and the chimney. The boiling appliances consist of an iron boiling pan 5′ x 5′ x 2½′ to take in four cubical immersion buckets or troughs of iron with perforated sides. A lid is put on, at the time of commencing the boiling.

Boiling: The furnace is lighted and fuel is fed uniformly. After an hour's boiling, frothing commences, and in a few minutes white fumes appear to be pushing out the lid. At this stage the lid is removed. The characteristic smell of cured turmeric develops in a short time and then the boiling is stopped. The troughs holding the turmeric are removed from the pan, while the boiling water flows back into the pan through the holes on the sides of the troughs. The boiled rhizomes are spread on a clean floor for drying. The troughs are again kept inside the boiling pan or tank and charged with another batch of fresh rhizomes. When fresh produce is put in, the temperature is slightly lowered. The water in the tank lost by evaporation is made up and boiling is continued. Each trough takes one bag of 168 pounds of rhizomes and each pan holds 4 troughs at a time. Each boiling takes one hour on an average. The produce from one acre can be cured in 20 boilings and it takes one day if non-stop curing is taken up, as is usually done. Eight men are required for attending to this work. Rounds and fingers are cured separately, as the former takes a longer time for curing.

Fuel: Dried turmeric leaves, redgram stalks, sugarcane trash, tobacco stems country date-palm leaves, babul twigs, and cheap forest wood are all used, depending upon the availability in the respective

localities. In the Duggirala area, the turmeric leaves are carefully conserved for boiling the rhizomes and this is supplemented with red-gram stalks. In other parts of Guntur district, babul twigs are purchased. In Krishna district, sugarcane trash and tobacco stems are used. In Prodattur area, country date-palm leaves are largely used. In other places of Cuddapah district, forest fuel is bought and used. Taking the whole area into consideration, the cost of fuel works out to Rs. 3/- per candy of cured produce. In Cuddapah district dried turmeric leaves are not used as fuel.

The cost of appliances and the labour charges for curing are as below :—

(a)	Construction of furnace, 2 men each at Rs.	1—4—0 per day.
(b)	Cost of iron rods and grating for the furnace Rs.	30—0—0
(c)	Cost of a set of one tank and four buckets at controlled prices. ...	225—0—0
(d)	Cost of pan or tank in local markets ...	240—0—0 each.
(e)	Cost of troughs in the local markets ...	20—0—0 each.
(f)	Hire charges for tank and troughs (full set) ...	1—0—0 per cdy.
(g)	Wages for the curers. ...	1—8—0 per cdy.

Other methods of curing: Previous to the introduction of the water-bath system of boiling described above, the produce was directly heated in iron pots or in pans. The same practice is still in vogue in a few remote villages of Krishna district where iron pots with a capacity of about 150 lbs. of fresh rhizomes are used. In Cuddapah district, the furnaces are much bigger and crude in form, resulting in waste of fuel and the produce is boiled in iron pans which are similar to jaggery boiling pans.

Drying and cleaning: The cured produce is dried on clean drying floors in a thin layer for 10 to 15 days till perfectly dry. Rounds and fingers are separately dried. The rounds take a longer time for drying. The rounds have some adhering roots, which drop off ordinarily during the curing and drying process. Whatever remains is removed by manual labour in some places. In Duggirala tract they are spread in a thin layer and over this straw is spread lightly and burnt. The rounds are kept carefully stirred so that only the roots get burnt. In Prodattur area the plank is drawn over a layer of rounds for the removal of roots and for smoothening the surface. The next process is cleaning. The rhizomes are well rubbed with old gunny pieces or with hand, taking a small basketful each time. This removes the adhering scales and roots and smoothens the surface. The produce is then cleaned by winnowing. This process of rubbing is not done now in Guntur area as machine polishing is done by the exporting firms, and polishing by hand is too expensive.

Yield: The average yield per acre is 10 candies (of 500 lbs. each) of cured produce. When there are pests and diseases, it may be 6 to 8 candies only. Maximum yields go upto 16 to 18 candies per acre. The proportion of cured produce to fresh produce is 1 to 4; i. e. about 40 candies of raw produce gives 10 candies of cured stuff. The proportion of rounds and fingers is also 1 to 4. Normally, 10 candies of rounds are obtained from one acre. On storage till the planting season there is a driage loss of about 5% and about 5 candies of rounds will be available for planting one acre.

(10) *Storage of seed material*: From the time of harvest in March — April, till the time of planting in July, the seed material is carefully preserved. The period of storage is 3 to 4 months. In Guntur and Krishna districts the material is invariably stored under the shade of trees. The seed material is loosely heaped and covered over with a thin layer of dry turmeric leaves. The heap is left undisturbed till required. In parts of Krishna the heap is removed after 1½ months, spoiled rhizomes, if any, are removed and reheaped. In the absence of shade nearby, a number of ryots store the material together in a garden engaging watch jointly, paying a nominal rent for the site. Throughout Cuddapah district the seed material is covered over with ragi straw or neem leaves; but not with dry turmeric leaves. A layer of sands is spread on the floor before heaping. The heaps are also plastered over with earth or dung or a mixture of both. The heaps are not disturbed. If there are no rains in summer, water is sprinkled over the heaps once. Where there is no sufficient shade, low pandals are erected over the heaps. There is also a practice of storing seed material in sheds if space is available. The rhizomes are heaped in a corner over a layer of sand and left uncovered.

11. *Storage of produce:* When the cured produce is not immediately disposed off it is stored in pits dug in an elevated site and allowed to dry for a day or two. The bottom and sides are lined with thick twists of "Rellu" grass *(Saccharum spontaneum)*. Over this layer of grass, country date mats are spread at the bottom and the pit is filled with the produce. At the top again mats are spread and over this "Rellu" is spread in a thick layer and finally covered over with earth.

In Guntur and Krishna, the normal size of the pit is 15'x 10'x 7' which holds about 200 bags. Charges for digging the pit and storing the produce are one anna per bag. Cost of grass for one pit is Rs. 49/- at 700 bundles costing Rs. 7/- per 100 bundles. Cost of 20 mats at 0—8—0 each is Rs. 10/-. For the site, rent is charged at 1½ annas per bag irrespective of period of storing. Banks advance money on the stored produce at Rs. 25/- a bag in Duggirala, which is a trading centre for turmeric. In

Cuddapah, the bottom of the pit is lined with paddy husk to a thickness of 9 inches and mats are spread over this layer. The side are lined with a type of wild grass available locally. Pits are circular and rhizomes are heaped over the pits also to form a cone. This type of storage is generally adopted in factory premises. Rent is charged for the site at Rs. 12/- per year for a pit with capacity of about 17 candies having the dimensions 12 feet diameter and 7 feet depth.

12. *Marketing:* Duggivala, Kodur and Cuddapah are important marketing centres for turmeric. The dealers send round commission agents to villages and purchase the produce. Generally the purchase is made at the ryot's door. At Duggirala, there is also the practice of the ryots bringing the produce to the merchants for sale. The agents get Re. 1/- commission per candy from the merchant. All the produce of Guntur and Krishna districts is pooled at Duggirala, and all the produce of Cuddapah and the adjoining districts at Kodur and Cuddapah, wherefrom they are exported.

(i) *Polishing:* Before exporting, the produce is polished in power polishers in all the three centres. A polisher consists mainly of an octogonal wooden drum 4½ feet long and 3 feet in diameter. The sides are made of thick iron sheets and the body is fitted lengthwise with wooden pieces 3 inches wide and 2 inches in thickness. In Cuddapah, 6″ wide planks are used. Babul wood or high class teakwood is used, the former being preferred. Generally a set of four polishers are maintained with an oil engine of about 25 to 30 B. H. P. The polisher is hollow inside. Through the centre a 2″ thick iron rod is fitted for supporting the drum on strong masonary blocks on either side. A pulley is also fitted to the same iron rod or axle for rotating the polisher. The barrel is provided with an opening 1½′ x 1′ which can be closed by means of a door. The polisher is charged through this opening. Each charge takes 7 bags of 168 lbs. each. There are bigger barrels taking 11 bags per charge, but they are not so common. After charging, the door is closed and the drums are rotated for about 1½ hours for "full polishing" at 30 to 35 revolutions per minute. About 7 charges are taken per day. After polishing, the rhizomes are smooth, light yellow in colour and fit for marketing. For certain markets, the produce is polished for only three-fourths to one hour and this called "half-polishing". In Cuddapah, half-polishing is largely in vogue and the rhizomes are later coloured to cater to certain markets. Normally, the factories work for about 8 months in a year. They charge Rs. 2/- to 2—8—0 per candy for full polishing and Rs. 1—8—0 to Rs. 2—0—0 for half-polishing. Certain factories confine themselves to polishing work, while certian others take up trading of rhizomes also. Labour is paid up fixed rates in these factories for the various items of work. Labourers working at the polishers are paid Rs. 12/- per 100 bags. For grading, women are employed at Rs. 4/-

per 100 bags. for weighment Rs. 6—4—0, for stalking Rs. 1—9—0 and for stitching Rs. 0—12—0 per 100 bags are the usual rates. The wooden planks of the polishers require renewal once in 2 to 3 years at a cost of Rs. 300/-. Some of the factories are leased out by the owners for working to others, in which case Rs. 8000/- are paid to the owner. All repairs above Rs. 200/- have to be borne by the owner.

(ii) *Colouring:* In Cuddapah, colouring is done before exporting to certain places like Calcutta, Rangoon, Singapore and Penang. This is done in two ways, dry colouring and wet colouring. In the dry method a yellow dyestuff (middle chrome) is lightly dusted on a small heap of rhizomes and thoroughly mixed. This method of colouring is for the Calcutta market. In wet colouring, the yellow colour is mixed in water and the coloured water is sprinkled over small heaps of rhizomes and rubbed well. The produce is then well dried for about a week. For both the purposes only half-polished stuff is used. Wet colouring gives a better-looking material, and fetches a better price in the market over the dry-coloured rhizomes. The colour that is used for this purpose is "Middle chrome" manufactured by International Chemical Manufacturing Company, Calcutta. It is sold in half-pound packets costing Rs. 1—8—0 each. A packet is used for treating 2 candies of turmeric. The colouring is done by dealers who use the premises of factory paying a rent of Rs. 2/- per candy for storage.

(iii) *Factories:* The location of turmeric factories and their capacities are given below :—

		Number of Factories	
1.	Duggirala–Guntur District	6	Each with 4 polishers.
2.	Tenali do.	2	do.
3.	Cuddapah	3	Two with 4 and 1 with 3 polishers.
4.	Kodur—Cuddapah District	2	Each with 3 polishers.

(iv) *Trade*: The following is the approximate quantities of produce handled per year in the various trading centres :—

1.	Duggirala	2,50,000	Bags
2.	Kodur	30,000	,,
3.	Cuddapah	30,000	,,

Another 2,00,000 bags per year are powdered and exported to various centres in this Province. The following are the importing centres.

(a) Within the Province :

1. Madras	2. Tiruchirapalli
3. Madura	4. Erode
5. Duggirala	

Erode and Duggirala import turmeric from other places and export it after polishing.

(b) Within India.

1. Calcutta	2. Delhi
3. Cawnpore	4. Agra
5. Amritsar	6. Bombay
7. Assam	8. Rangoon
9. Karachi	10. Nagpur
11. Chittagong	12. Lahore

(c) Outside India and Burma :— (Pre-war annual Export 2000 tons roughly).

1. Iraq 2. Iran 3. S. Africa 4. Germany

(v) *Foreign exporters* :—

1. Gordon Woodroffe & Company
2. Volkart Bros.
3. Krishna & Company, Tuticorin
4. B. L. Narayana & Company, Cocanada
5. D. Ananta Rao & Company, Madras
6. Mittalal & Company, Madras

(vi) *Prices :* The prices during May 1948, ranged from Rs. 180/- to 210/- per candy of 500 lbs. The maximum price reached was Rs. 270/- in 1947 and the minimum was Rs. 27 per candy in 1937. The average price over a long period was Rs. 80/- per candy. Normally fingers sell at a higher rate, with a difference of about Rs. 10/- a candy. But, during this year the rounds are selling at a higher rate with a difference of Rs. 20 to 30/- a candy. The prevailing prices at the consuming centres ranges from Rs. 250/- to 300/-. The estimated net average profit realised by traders is about Rs. 20/- per candy.

(vii) *By-Products :* During the process of polishing, the fine yellow dust that gather is collected and used as manure for paddy fields. It is said to give good results. It is sold at Rs. 1/- per bag.

13. *Pest and diseases :* The crop frequently gets the "leaf spot" disease known variously as "Thataku tegulu", "Lambadi tegulu" "Jampu tegulu" and "Yerrapoda" in different localities. "Rhizome rot" occurs now and then and is called "Pippi tegulu" and "Kommu tegulu" where the rhizomes decay and become soft. Rarely, the base of the plants

and the rhizomes are attacked by borers and this is called "Oola telugu" and "Morum". Generally, the incidence of pests and diseases is not high and no serious damage is caused. Bordeaux mixture checks the leafspot disease if the plants are regularly sprayed with it. When the cured produce is stored for a long time in gunnies, it is attacked by borers. The produce is therefore stored in pits, to avoid this.

14. *Cost of Production:* The average costs of production at the current rates are:

1.	Seven ploughings at Rs. 3/- per ploughing	Rs. 21/-
2.	30 carts clay @ Rs. 2/- including carting	60/-
3.	Cost of penning 800 cattle (labour only)	40/-
4.	Penning 2000 sheeps @ 12—8—0 per 1000	25/-
5.	Cost of 50 cart cattle-manure Rs. 3 per cart load	150/-
6.	Cost of carting the @ 0—8—0 per cart	25/-
7.	Cost of 8 bags of groundnut cake @ Rs. 8—8—0 each	68/-
8.	Spreading manure and covering	5/-
9.	Cost of 4½ candies seed material at Rs. 50/- a candy	225/-
10.	Preparation of seed material and planting	8/-
11.	4 Weedings ... 100 women	50/-
12.	4 Ploughings ... 4 pairs	12/-
13.	Water rate and labour for irrigation	15/-
14,	Harvesting, gathering and separating rhizomes	35/-
15.	Curing, drying, and cleaning charges Rs. 5 per candy	50/-
16.	Transport and storage charges	11/-
	Total Rs.	800
	Value of 10 candies of produce @ Rs. 110/- per candy	1100
	Net Profit per acre	910

HINTS TO FARMERS

Hints on the preparation of Artificial Farmyard Manure : (*Compost Manure*) — Application of adequate amounts of bulky organic manure for providing humus to the soil is an absolute necessity for maintaining soil fertility and for increased crop production. As the farmyard manure the chief source of supply of humus to the soil is however greatly inadequate to meet the needs of the existing area under crop, attempts to tap other sources of supply led to the result that any carbonaceous organic material such as agricultural wastes, weeds, leaves, grass, etc., can be easily converted at no great cost into a substance similar in appearance and manurial value to the farmyard manure by comparatively simple methods.

On a consideration of the several methods of composting developed by different workers in India, the following general procedure is recommended for adoption.

Pits 5′ to 6′ broad, 15′ to 20′ long and not more than 3′ deep, may be dug on elevated ground. The organic material, preferably a mixture of several waste substances, is spread on the bottom of the pit to a depth of 6″ to 9″. If the basic material is dry, it may be dipped in water and the water drained, before putting, in the pit. If moist, the stuff may be placed straightaway in the pit. Wood ashes and urine earth are sprinkled over the layer of the organic matter followed by a fairly thick emulsion of cowdung. Another layer of the raw material is piled above to a thickness of 6″ to 9″ and treated with wood ashes, urine earth and cowdung water as described for the first layer. The heap in the pit is thus built up to a foot or two above ground level. The surface layer may be made dome-shaped and treated with cowdung water, wood ashes and urine earth. After four or five days, the top surface is covered with a 3 to 4 inch layer of earth. The earth cover serves to conserve the moisture within the heap, to prevent rain water getting in and to absorb any ammonia that might otherwise escape into the air.

After five to six months and with ordinary materials, not too coarse or woody, the decomposition will be found to be satisfactory. If the manure is required sooner, the heap may be opened at the end of the first month and the contents given a turning with adequate watering and repiled. Two more turnings at the end of the second and third months will complete the decomposition. Frequent turnings and waterings no doubt promote the rate of decomposition but add considerably to the cost of production.

The main considerations that have to be borne in mind in converting farm and other wastes into compost manure by biological means are as follows :—

1. *An adequate supply of available nitrogen*: This condition is more likely to be attainable by putting into the compost heap a mixture of a variety of substances than material of a particular kind. Cowdung and particularly urine earth provide nitrogen as well as the organisms needed for decomposition.

2. *Proper aeration and moisture*: As the formentation is brought about chiefly by aerobic organisms, the heap must be so built as to allow sufficient air maintained at about 50 to 60 per cent of the material.

3. *A neutral reaction*: As the products of decomposition are likely to produce acid conditions in the heap and as a neutral or even a slightly alkaline reaction is considered favourable, sprinkling of wood ashes over every layer of the material is recommended.

The compost manure prepared as above has been found to compare very favourably with farmyard manure in respect of soil improvement and increased crop production. (Villagers' Calendar 1948.)

REVIEW

Food Problem in India in General and in Kolhapur in Particular — By Dr. P. C. Patil: Dr. Patil, a pioneer in the field of agricultural economics, deals with the burning problem of the day which tends to become more and more acute as days go by. India and Pakistan, he estimates, will have in 1971 a population whose food requirements will be double the present. He traces the growth of the problem in recent times and dispels some unfounded notions that there is any extent of culturable land in India, that our land is a *swarnabhumi*, superior in fertility to lands in other countries, that our climate and rainfall are on the whole favourable for crop production — all resulting in the belief that our population is not excessive for the land we have. But we have in fact only 8 acres per capita in India. The situation has indeed grown worse since the partition of the country, which has not been stressed. Information of a familiar kind is furnished on functions of food, on the calories required for sedentary workers and manual workers 2500 and 3500 calories respectively. The deficit in different kinds of food as estimated by Dr. Burns is given though the statistical basis for estimates of vegetables, fruits, milk etc., is flimsy. Dietary conditions of different groups of society are pictured but are not based on any elaborate data collected over a wide area. We are told that the diets of the first two groups are satisfactory. We are not sure whether they are so qualitatively. But we are sure that 65 per cent of the population do not get enough food grains.

Dr. Patil is of the view that the problem of food production can be solved best by the construction of irrigation works — major and minor so far as western India including Kolhapur is concerned — particularly by the construction of Koyna and Daddi projects. The Kolhapur ryot is said to be keen and progressive especially in lifting water by a series of mhotes or oil engines for cultivating sugarcane on a large scale. The ryot at Coimbatore does as well in lifting water from very deep wells and now-a-days is resorting to electric pumping for the cultivation of a variety of garden crops.

He praises the work of the Regency Council in the past in putting up dams across rivulets, in sanctioning loans for digging wells at 2 per cent (but only up to Rs. 6 lakhs) and in the work of reafforestation of Satyayadri hills. But Kolhapur has now ceased to be an independent state, we are sure however, that by its merging in a wider Province with far greater resources it will not suffer — K. C. R.

Gleanings.

Twenty years of cotton Research in Egypt: Looking back over these twenty years, one cannot but feel regret that more was not done with the results obtained. Lack of concentration and sustained attention was due in part to the overweighting of the technical sections with accessory staff, which in turn involved distracting administrative responsibilities for the senior scientific officials, conducted within the limitations of rigid governmental rules and regulations. Promotion for good service was hard to obtain. The scientific worker devoted to his subject was too fully occupied to have the time for acquiring the necessary influence. Publication of results was very uneven and the war made matters hopelss; brevity is usually a sure indication of clear thinking and scientific value, but the tradition of the East put a premiun on prolixity and the emphasis is onwords rather than on work. The acquisition of status and power over fellow officials is too often valued far above scientific reputation and experimental ability and it is yet to be realised that for real progress in science it is essential to have a stiffening frame of professional scientists as distinct from professional officials (W. L. Balls (1948) Emp. Cotton Growing Review 25. [T. R. N.]

New Treatment for Cattle Disease: Glaxo Laboratories, who a year ago pioneered the massive dosage technique in the penicillin treatment of bovine mastitis, have announced an important advance in the treatment of this widespread disease. By combining procaine with penicillin rapid and complete eradication of bovine mastitis, it is claimed, can be achieved, with only two injections within 72 hours, instead of the four or five previously necessary with ordinary penicillin. This is the first time in veterinary medicine that procaine-penicillin has been used in the treatment of bovine mastitis.

The great advantage of the new preparation is that procaine-penicillin, supplemented by a strong water-repellent agent, aluminium stearate, results in an extensive prolongation of penicillin activity in the milk system and associated tissues by reducing the number of treatments per quarter to a minimum. The veterinary surgeon is thus able to give greater personal attention to herd treatment, and the cost per head is less. The preparation, which is non-irritant, leaves the milk free from discoloration. The yield is also unaffected by the process, which ensures only a minor disturbance to the animal.—[B. F. 958]

Scientific Grain Storage New Methods of Combating Infestation: Several successful methods for combating infestation in the storage of grain are mentioned in the first report now issued on pest infestation research in Britain. One of these is the "carbon dioxide" method for estimating the infestation of a given sample of grain. This consists of bottling a sample and incubating it for a short period, generally 24 hours, after which the carbon dioxide content of the air between the grains is measured. The grain itself produces a negligible amount of carbon dioxide in such a time, but the insects produce a measurable quantity. Broadly, the concentration of carbon dioxide found is proportional to the number of insects present inside the grain. It was also demonstrated that insects could and did cause grain to heat through the formation of "hot spots".

The report says that there was a great need for a fumigant as toxic to insects as hydrogen cyanide, which would not be so easily absorbed. Such a fumigant was found in methyl-bromide. The first full scale trials were made on empty bags on barges. Bagged shellnuts were then treated and also groundnuts in shell which were loose in barges. The treatment of bulked materials in barges had always been considered impracticable. Work on warehouse sprays was undertaken in view of the necessity of disinfecting the building in which insect free foodstuffs had to be stored. The main difficulty was ensuring a reasonably long toxic life to the insecticide film deposited on the wall. A method was developed for pre-treating surfaces to be sprayed which gave a greatly increased duration of toxicity. The report covers some years' work by the Pest Infestation Laboratory of the Department of Scientific Research and is published by the British Stationery Office. [B. F. 1483]

New Farm Implements: Two new farm implements, *a potato planter* and *a fertilizer distributor*, both costing well under £ 100 (Rs. 1,333), have been developed in the United Kingdom. Both are automatic and operated by a tractor, the driver needing no other labour. The two-row potato planter comprises a sport-welded steel hopper containing baffles and an inverted V bottom. The drive is by a wavy-edged wheel. By means of sprockets and chains, motion is transmitted to two disc wheels which collect the potatoes into pick-ups on the perimeter, each comprised of two prongs and a lip, and drop them into furrows prepared by two ridging bodies. Potatoes can be planted at a space of 15, 20. 24 and 30 inches at the rate of six to eight acres per day. The fertilizer distributor, claimed to be the first mounted distributor in Britain, has a capacity of 3 or 4 cwt., and sows from 1 to 30 cwt. per acre. An unusual feature is the main drive which is by a chain from a sprocket mounted by three studs on the near-side wheel hub of the tractor. The machine weighs well under 6 cwt. [B. F. 1415]

Vitamins and Social Dominance: A chromic deficiency of vitamin B has a profound influence on social dominance and behaviour. This has been established by experiments on dogs, hens, mice canaries and cattle. Chromic vitamin B, deprivation in dog litters effect the order in which the puppies go to the food pan, the tendency to relabate when bitten by others, and the relative or absolute immunity of any animal in the group from attack by other animals. In one bitter of four male and one female pups, the least dominant animal, a male was severely bitten and so regularly driven away from the feeding pan, that it had to be isolated in a separate cage and given a special diet, which included milk and raw beef. The other animals were placed on a diet of water canned dog food and a type of dry dog chow. After three weeks the isolated animal was again placed in the cage with his lither mates and none the previous social demeniance was reversed. He became the dominant animal of the lither after several fights with each of his lither mates. After a week of this, an increasing loss of appetite followed by symptoms of "fright disease" was noted in those animals which had been fed for several weeks on commercial dog food ration. Commercial dog foods are usually anthclaved and vitamin B, being heat labile is destroyed as a result. 600 I units of vitamin B were injected subcutaneously in all five animals daily for four days. A number of fights ensued between the litter mates and the previous dominant male resumed his acendant position in the social hieracty. The male which had orginally been the lowest and after the special diet highest in the order of dominance ended as the third highest in the social group of litter mates. The solitary female pup was the lowest in the new order of dominance which remained so for two months, after which no further observations were made. Similar dominance shifts associated with vitamin B, deprivations have been noted, though not in such detail, in other lithers as well. (Science 105, March 1947, p. 57, T. R. N.)

Crop and Trade Reports

Statistics — Crop — Groundnut — 1949 — Summer and early crops — Condition Report : Sowings of the Summer crop of groundnut are reported to be below normal in the districts of Chingleput, Chittoor and North Arcot due mainly to the failure of rains. The area sown with Summer Crop in the other districts is reported to be normal. Sowings of the early crops are in progress in the districts of Salem and Coimbatore and the area is reported to be normal in both the districts.

2. The Summer crop of groundnut has been harvested in most of the districts. The yield per acre is expected to be normal in the districts of Cuddapah, Tiruchirapalli, Tanjore and Mathurai and below the normal in the other districts due mainly to inadequate supply of water from irrigation sources.

3. The wholesale price of groundnut (shelled) per Imperial Maund of 82 2/7 lbs. (equivalent) to 3,200 tolas as reported from important market centres on 2nd July 1949 was Rs. 29—1—0 in Adoni, Rs. 29—0—0 in Coimbatore, Rs. 28—6—0 in Guntur, Rs. 27—14—0 in Cuddalore and Salem, Rs. 27—9—0 in Tadpatri, Rs. 27—7—0 in Nandyal, Rs. 26—6—0 in Hindupur, Rs. 26—2—0 in Vizianagaram, Rs. 25—9—0 in Bellary, Rs. 25—7—0 in Vellore, Rs. 25—4—0 in Erode and Rs. 23—8—0 in Cuddapah. When compared with the prices published in the last report i.e those which prevailed on 9—4—1949, these prices reveal an increase of 2 per cent in Adoni, 9 per cent in Guntur, 8 per cent in Tadpatri, 7 per cent in Salem, 6 per cent in Cuddallore, 4 per cent in Nandyal and Erode, 2 per cent in Coimbatore and 0·2 per cent in Hindupur, the price remaining stationary in Cuddapah. (Public Economics and Statistics Dept.)

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 to 8th July 1949 amounted to 2,18,837 bales of 392 lb. lint as against an estimate of 3,01,800 bales of the total crop of 1948—49. The receipts in the corresponding period of the previous year were 2,55,711 bales.

2,86,714 bales mainly of pressed cotton were received at spinning mills and 2,835 bales were exported by sea while 61,828 bales were imported by sea mainly from Karachi, Bombay and Egypt.

Agricultural College and Research Institute Library, Lawley Road P. O., Coimbatore

MONTHLY LIST OF ADDITIONS FOR JUNE 1949

1. BENNET (H.): Practical Emulsions. Edition 2. 1947
2. CAMP (H. W.) etc., International Rules of Botanical Nomenclature. 1948
3. COLIN (Edward C.): Elements of Genetics, Mendel's Laws of Heredity with Special Application to Man. Edition 2. 1947
4. SAVES (Y. R.) and MAZUYER (G): Natural Perfume Materials — A Study of Concretes, Resinoids, Floral Oils and Pomades. 1947
5. PARRY (J. N.): Spice Hand-work, Spices, Aromatic Seeds and Herbs. 1945
6. REYNOLDS (P. A.): Farm Mechanisation, Hand-book and Manual. 1948

Weather Review — For June 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	2·0	−3·5	2·8
	Calingapatam	2·9	−1·8	4·5
	Vizagapatam	3·1	−1·0	9·6
	Anakapalle*	2·1	−1·2	8·5
	Samalkot*	2·7	−1·9	5·7
	Kakinada	6·6	+1·9	10·1
	Maruteru*	4·6	+0·8	8·7
	Masulipatam	3·1	−1·1	6·3
	Guntur*	5·0	+1·1	10·1
	Agrl. College, Bapatla	3·2	+1·2	6·0
	Veeravanam (College Farm)	3·5	(x)	5·3
Ceded Dists.	Kurnool	4·5	+1·6	8·6
	Nandyal*	6·0	+2·9	8·8
	Hagari*	1·4	−0·3	4·6
	Siruguppa*	3·1	−0·7§	5·6
	Bellary	1·7	Norml	4·1
	Rentichintala	7·6	+4·0	11·1
	Cuddapah	4·5	+1·5	7·0
	Anantharajpet*	4·9	+2·3	8·4
Carnatic.	Nellore	1·7	+0·4	11·2
	Buchireddipalem*	2·1	+0·7	7·5
	Madras	4·0	+2·1	12·9
	Tirurkuppam*	7·5	+5·3$	14.0
	Palur*	6·3	+5·4	10·8
	Tindivanam*	4·6	+2·8	6·1
	Cuddalore	4·2	+2·8	8·5
Central.	Vellore	7·9	+5·1	12·1
	Gudiyatham*	8·4	+6·3	10·7
	Salem	4·7	+1·6	13·3
	Coimbatore (A. C. R. I.)*	0·2	−1·4	4·3
	Coimbatore (C. B. S.)*	0·4	−1·3	4·1
	Coimbatore	0·2	−1·3	5·2
	Tiruchirapalli	2·4	+0·6	7·0

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	1·0	−0·2	5·7
	Aduturai*	2·6	+1·8	6·0
	Pattukottai*	0·6	−0·5	3·5
	Mathurai	1·2	−0·4	12·7
	Pamban	Nil	−0·2	8·3
	Koilpatti*	1·5	+1·1	8·1
	Palamcottah	Nil	−0·4	9·9
	Ambasamudram*	0·4	−1·0	5·8
West Coast.	Trivandrum	10·9	−2·3	26·3
	Cochin	22·9	−5·6	48.8
	Calicut	25·3	−9·5	57·8
	Pattambi	21·9	−5·2	41·7
	Taliparamba*	31·7	−13·5	52·1
	Nileshwar*	44·8	+2·9	71·4
	Pilicode*	38·2	−5·4$	59·1
	Mangalore	45·0	+4·8	68·1
	Kankanady*	43·7	+5·0	66·6
Mysore & Coorg.	Chitaldrug	2·1	−0·5	5·3
	Bangalore	3·7	+0·8	7·4
	Mysore	1·6	−0·9	9·2
Hills.	Mercara	17·4	−8·1	32·3
	Kodaikanal	4·1	−0·1	13·4
	Coonoor*	1·6	−2·1	10·8
	Ootacamund*	5·2	−0·6	16·9
	Nanjanad*	2·7	−5·8	10·9

Note :— (1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal.

(3) x Readings are being recorded only from February 1948.

(4) § Taluk office normal is 3·04", and Rainfall is 2·30".

(5) $ Average of six years data for Tirurkuppam, and seven years data for Pilicode is given as normal.

Weather Review for June 1949.

The South-West Monsoon established itself in South Malabar on the 3rd June 1949 and was active in the South Konkan and Malabar respectively upto 10—6—49 and 13—6—49. In fact, on 14—6—49 the monsoon had temporarily withdrawn from the West Coast of the Peninsula and North-East India. This break in monsoon continued for three days. Three days hence the monsoon again became active in Malabar and the South Konkan, and continued to be so for six days. Once again, a general weakening of the monsoon along the West Coast was noted on 26—6—49; from thence it has not gained any vigour till the end of the month.

Monsoonic showers were received in many parts of Tamilnad, Andhradesa and Rayalseema. Pariticulars regarding the heavy falls are detailed below:—

Serial Number	Date or dates.	Place.		Rainfall in inches
1.	1—6—49	Calicut	...	3·0
2.	3—6—49	Vellore	...	2·3
3.	,,	Cuddapah	...	2·1
4.	8—6—49	Alleppey	...	2·8
5.	20—6—49	Cochin	...	2·6
6.	24—6—49	Mercara	...	2·7
7.	27—6—49 & 28—6—49	Mangalore	...	4·5

The month began with a fairly severe summer in Kakinada. Places like Ongole, Masulipatam, Rentachintala and Negapatam had the spell of summer weather in the course of the month under review.

Monsoon Forecast for June to September 1949. (Indian Daily Weather Report dated 9—6—49: matter reproduced as given in the report).

" 1. Of the forecasting factors used in forecasting the monsoon rainfall in the Peninsula (consisting of Gujarat, Saurashtra and Cutch, the Konkan, the Bombay, Deccan, the Central Provinces, Hyderabad and Northern Madras Presidency), the South Rhodesian rain and the Java rain are very favourable. The South American pressure is indifferent but the Dutch harbour temperature is moderately unfavourable. Taken as a whole, there is a four to one chance that the total monsoon rainfall in the Peninsula during the month June to September will be above 98% of the normal.

2. Of the factors used to forecast the total monsoon rainfall in North-west India (taken to consist of the West United Provinces, the East Punjab, Kashmir and Rajputana), the South Rhodesian rain is very favourable. The equatorial pressure is favourable, the South American pressure and Dutch harbour temperature and the Himalayan snow accumulation are slightly unfavourable. Taking all the factors together, there is a four to one chance that the total monsoon rainfall of June to September 1949 in North-West India will be above 92% of the normal.

3. There is a four to one chance that the total monsoon rainfall in North-east India during the months—June to September 1949 will be between 90% and 110% of the normal.

4. **Summary of the Monsoon Forecast:** There is a four to one chance tha the total monsoon rainfall during the months – June to September 1949 in the Peninsula and North-west India will be either normal or slightly above normal and in North-East India very nearly normal".

M. B. V. N. & C. B. M.

Departmental Notifications

GAZETTED SERVICE—POSTING AND TRANSFERS

Name of Officers	From	To
Janab Ansari Baig	D. A O., Cuddapah,	Deputed to Sholapur for Training in Soil Conservation.
Sri Venkateswara Iyer, P. A.	Superintendent C. F.,	Special Lecturer in Agriculture, Agricultural College, Bapatla.
,, Krishna Reddy, T	On leave,	Special D. A. O., Arakev, Vizagapatam District.
,, Ramakrishna Rao, K. L.	D. A. O., Nellore.	D. A. O., Tanjore.
,, Satyanarayanamoorthy, M.	D. A. O., Ooty,	D. A. O., Cuddapah.
,, Subbiah Mudaliar, V. T.	S. L. A., Agricultural College, Bapatla,	L. A., Agricultural College Coimbatore.

APPOINTMENTS

Satyanarayanamoorthy, K.	Assistant in Plant Physiology Agricultural College, Bapatla.
Miss. Sarasvathi, P.	Demonstrator, Cocanada, (Fruit and Fruit Products Development).
Srimathi Sabharan Jemmes	Assistant in Paddy A. R. S., Maruteru.
Sri Balasubramanian, C. R.	Cotton Assistant for Winter Scheme, Coimbatore.
,, Ayyamperumal, S.	Cotton Assistant—Tinnies' Scheme, Koilpatti.
,, Appadurai, R.	Millet Assistant, M. B. S., Coimbatore.
,, Balasubramanian, A.	A. D., Rasipuram.
,, Balraj Joseph, J.	A. D., Tiruvannamalai.
,, Chacko, C. J.	Assistant in Fruits—Coonoor.
,, Chandrasekaran, H.	A. D., Gudiyatham.
,, Ebenezer, J	A. D., Plant Protection Scheme, Tanjore.
,, Gopalakrishnan, V.	A. D., Arni.
,, Gopalan, N.	Assistant in Oil Seeds A. R. S., Tindivanam.
,, Jayaraj, M. V.	Cotton Assistant for Winter Scheme, Coimbatore.
,, John Knight,	A. D., Wandiwash.
,, Krishnamoorthy, C.	A. D., Tiruvellore.
,, Mutharasan, G.	Cotton Assistant A. R. S., Palur.
,, Mathew, K. T.	Assistant in Entomology—Waynad.
,, Muthuswamy, K.	A. D., Nannilam.
Miss. Mukta, M.	Assistant in Mycology, Coimbatore.
Sri Makudeswaran, K.	Assistant in Millets, M. B. S., Coimbatore.
,, Prabuswami, G. R.	A. D., Virdhachalam.
,, Rama Rao, B K.	A. D., Karkal.
,, Ramakrishna Nambiar, C.	Assistant in Oil Seeds A. R. S., Tindivanam.
,, Ramachandran, K.	Assistant in Cotton—Tinnies' Scheme, Koilpatti.
,, Ramakrishnan, G.	A. D., Kulitalai.
,, Ramadoss, R.	A. D., Tiruvarur.

Sri Shanmugam, S.	A. D., Pudukottai.
,, Sankarankutty, M. M.	F. M, A. R. S., Pattambi.
,, Stephan Mathias,	Assistant in Paddy, Mangalore.
,, Sethuraman, V.	Cotton Assistant, Palur.
,, Srinivasan, K.	Cotton Assistant, Winter Scheme, Coimbatore.
,, Sankarayya, M.	A. D., Dindugul.
,, Solyappan, B.	A. D, Vellore.
,, Viswanathan, M. A.	Cotton Assistant Winter Scheme, Coimbatore
,, Vinayakam, S.	A. D., Chengam.
,, Venkatasami, S.	A. D, Harur.
,, Vedachalam, C. D.	A. D., Aruppukottai

POSTING AND TRANSFERS

Name of Officers	From	To
Sri Hanumantha Rao,	Assistant in Plant Physiology Agricultural College, Bapatla,	Farm Manager, Bapatla.
,, Rajanna, B.	A D., Nannilam	A D. Rayadrug.
,, Narasimha Rao, T. H.	A. D, Wandewash,	Cotton Assistant, Hagari.
,, Ramamohana Rao, S.	A. D, Chengam.	A. D, Anantapur.
,, Ragavendra Rao,	A. D., Gudiyatham,	A. D., Gooty.
,, Narayana Rao, K.	A. D. Gooty	Journal Assistant Kannada D. A's Office, Madras.
,, Hanumantha Rao,	A. D., Harur,	A. D., Punganur.
,, Vasudeva Rao,	A. D., Vellore,	A. D., Bimilipatam.
,, Venkiah, P.	A. D., Tiruvannamalai,	Sp. A. D., Sugarcane Development, Hindupur.
,, Parthasarathy, T. K.	Engineering Supervisor Coimbatore,	Deputed to Sholapur for training in Soil conservation.
,, Gopalakrishnan, R.	Assistant in Paddy A. R. S., Pattambi,	Journal Assistant for Malayalam D. A's office, Madras.
,, Narayana Reddy, B.	Spl. A. D., Sugarcane	Deputed to Sholapur for training in soil conservation
,, Nageswara Rao, S.	A. D. Pollachi,	F. M. Hagari
,, Seethapathi Rao, C.	F. M. Hagari	Deputed to sholapur for training in soil conservation
,, Sitaramaswamy, U. B.	F. M., Araken,	F. M., Government Dairy, Vizagapatam.
,, Narasimha Sastry, M. V.	F. M., Government Dairy, Vizagapatam,	F. M., Agricultural College, Bapatla.
,, Naidu, S. V.	F. M., Bapatla,	A. D., Markapur.
,, Thomas, M.	F. M., Nileshwar II,	F. M., Wynad, Colonisation Scheme.
,, Venkataratnam, G.	On leave,	A. D., Chicacole.
,, Ramakrishna Raja, K.	A. D., Chicacole,	F. M., Samalkot.
,, Subramania Iyer, K. K.	A. D., Tindivanam,	A. D., Tanjore.

	Name of officers	From	To
Sri	Shanmuga Nainar, T. P.	A. D., Tanjore,	Deputed for Training in Engineering at Coimbatore.
,,	Balraj G. J.	On leave,	F. M., Palur.
,,	Kristnamoorthy Rao, S.	P. A., to D. A O., Bellary,	Special A. D., Thunga-bhadra Project.
,,	Muthuswamy, P. N.	Sp. A. D., firka development, Tirumangalam,	A. D., Tirumangalam.
,,	Sitaramyer, D.	A. D. Tirumangalam	A. D., Kanigiri.
,,	Sankara Reddy, G. H.	On leave	Soil conservation Assistant, Bellary.
,,	Mohamad Zaimulabdeen	On leave	F. M. Arakuval.
,,	Satyanarayana, T.	F. M. Palur	Sp. A. D., Tobacco Works, Sendarampatti.
,,	Jagannathan, A.	Kannimetta, A D., Chicacole.	A. D., Gummalakshmipuram.
,,	Hanumantha Rao, M.	F. M., Palur,	Narasaraopet.
,,	Rama Rao, M.	F. M. Palur,	White Northern's Scheme, Nandyal.
,,	Olulapathy Choudry	Narasaraopet,	Do.

RETIREMENT

SRI R. N. K. SUNDARAM, C. D. A., N. D. D. In the retirement this month of Sri R. N. K. Sundaram, Senior Lecturer in Agriculture, Agricultural College, Coimbatore, the Madras Agricultural Department loses one of its able and experienced officers and the Madras Agricultural Students' Union, one of its sincere well-wishers. Sri Sundaram had his early education at the St. Gabriel's High School, Madras and in 1915 left for the United Kingdom, where he continued his studies in Scotland, in the Agricultural College affiliated to the Glasgow University. In 1919 he qualified for the C. D. A. and N. D. D., the brightest qualifications obtainable in Dairying in England and Scotland at the time. After completion of his studies, he was employed as assistant in Botany in Glasgow Agricultural College, a post which he resigned shortly to return to India. He was appointed in 1921 as Assistant Director of Agriculture in the Madras Agricultural Service and those early days of the Department was responsible for a great deal of pioneer work in the organisation of Co-operative seed form societies for the production of Co. 2 cotton seed in the Coimbatore and Salem district. Later as Assistant Director in the Circars Area, he was able to organise an effective large scale propaganda for cultural and manurial trials on paddy and sugarcane. He was responsible for popularising the green manure legume pillepesara; in Rajamundry from where it has now covered practically the whole of East and West Godavari districts. In fact it may be said without exaggeration, that in the course of the 28 years of service in the Agricultural Department, he has been able to do something good in practically every district of our Presidency. He combines, to a degree that is all too rare in those days of narrow specialisation, a wide range of knowledge and interests, together with a wise and tolerant outlook on all controversial issues and was for a number of years — a very helpfull member of the Madras Agricultural Students' Union. We wish him many long and happy years of retired life.

The Madras Agricultural Journal

Vol. XXXVI AUGUST 1949 No. 8

CONTENTS.

TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high — and the Editorial Board will feel obliged if your articles are brief.

The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI August 1949 No. 8

Editorial

The Thirty-second College Day and Conference: The annual College Day and Conference was a great success. The conference had for the main topic of discussion, "How best to translate the results of research into farming practices" and a number of interesting papers dealing with the various aspects of the problem were contributed. The Premier of Madras who inaugurated the conference after analysing the various causes that led to the present food situation in the country, dwelt on the steps taken by the present Government towards the improvement of the conditions of the agriculturist and emphasised the need for making an all-out effort to reach the target of self-sufficiency within the prescribed time limit of two years. He exhorted the public servants, especially the members of the Agricultural department to approach the cultivator in a spirit of service and sympathy rather one of patronage and power, in order to "harmonise the result of researches in the laboratories with the traditional ways of cultivators". It is significant that not only the Premier but also the Minister for Agriculture and the Director of Agriculture laid emphasis on the need for the right approach to the ryot as the first essential towards successful propaganda in agricultural matters. All the three stressed that the Indian ryot in spite of his illiteracy and poverty is not so ignorant of agricultural matters as he was supposed to be by superficial observers. The members of the Agricultural department more than any others are fully aware of this fact and we suppose it was the patronising and superior attitude assumed by the foreign experts in the earlier years that has led to the general belief that the 'Scientific Exper' is belittling the agricultural knowledge of the Indian Cultivator. But, nevertheless, it is well to be reminded of the fact and we would request the younger members of the department to make a special note of this advice.

Mr. A. B. Shetty in his speech dwelt on an aspect of the food problem which has not yet received sufficient attention on all hands, that is, the regulation of the population in relation to available food supplies. In a country like India the problem is both a delicate and difficult one, but one, which merits more attention and thought than it receives at present.

The Minister for Agriculture and the Director of Agriculture emphasised on the need for allocation of a greater share of the provincial revenue towards agricultural development. The allotment of Rs. 1·36 crores forming only 2·4% of the total revenue is all too meagre for doing justice to the most important industry of the province. The present food crisis has brought to the forefront the price we have to pay for neglecting agriculture and we hope that the days of treating agriculture as the Cindrella of Administration are once for all passed.

The several papers that were read at the Conference were unanimous that more demonstration farms should be opened where the ryot could see for himself the results achieved by research and take up such of those improvements he felt convinced would lead to improved returns on his lands.

Second year of Independence: Two years have passed since the country has gained Indepence. In this short period the country had to face great tribulations and trials. Millions of our people had to undergo untold hardships as a result of the partition. Mahathma Gandhi was killed but thanks to the ability and steadfastness of its present leaders, the country has weathered the storm and has survived the ordeal. The Food Problem is now facing us and the Prime Minister of India has immense faith in her people and we have no doubt that they will not let him down.

Varieties and Forms of the Coconut

(*Cocos nucifera* Linn.)*

By

G. V. NARAYANA & C. M. JOHN

The Country of Origin: The coconut belongs to the family of palms viz., *Palmaceae*. It is a very useful tree cultivated by man from very ancient times. De Candolle and others consider the Indian Archipelago to be the original home of the coconut. It is a unique species in respect of the characters of the stem and the nut and is very much unlike any other known species of *Cocos*. The coconut stands in a class by itself. There are some thirty species of *Cocos* and all these are wild in native America, though some of them have been brought under cultivation for ornamental purposes. If all the known species of *Cocos* have an American origin, it is difficult to explain how the coconut alone originated in the Indian Archipelago; and some (Bailey 1937) believe that America is the home of the coconut. By some others, the millions of years old fossil coconut of New-Zealand which is of the size of an arecanut is considered to be the progenitor of the present–day coconut. The consensus of opinion, however, regarding the origin is that the Indian Archipelago should be the original home of the coconut.

Variations in Characters: The generic name *Cocos* is derived from a Portuguese word for a monkey. The eye end of a coconut when the husk is removed, resembles the face of a monkey; and the specific name *nucifera* refers to the kernel bearing nature of the nut. The palm has been in cultivation for several centuries under varying conditions of soil and climate, up to 20° to 23° of latitude on either side of the equator and from the sea level up to an altitude of about 3,000 feet Therefore, naturally considerable variations in the characters of the species occur. The stem may be thin or robust and its length may vary from just a few feet to 100 feet or more. Even in grown-up palms the length of the leaf and the petiole varies. A fully opened leaf may be 10-17 feet long depending on the nature of the soil and the age of the palm. The flower bunch (inflorescence) may be branched (a spadix) or rarely unbranched. The number of male and female flowers varies considerably, the former from 150-14,000 and the latter from 25-600 in a single inflorescence. The method of pollination may

* Paper presented at the Thirty-second College Day and Conference.

be cross or self. The time taken from pollination till the nut is ripe is 9 to 12 months. The shape of the nut ranges from linear to spheriod. The weight of copra or dried kernel which is the most important coconut product of commerce ranges from about an ounce to about 12 ounces. The percentage of oil (on moisture-free basis) in the copra varies from 65 to 75 (by chemical extraction). The life of the palm extends from 35 to 100 years. The range of colour variations also is considerable. The leaves and nuts may be green, yellow or rarely red or shades of brown. From the foregoing it is evident that the coconut is a variable species and one would expect a large number of varieties occurring in different coconut countries of the world. But considering the antiquity and the cosmopolitan nature of the species, the number of the so-called varieties of the coconut is rather limited. From a reference to the literature on the subject, it appears that the total number of the varieties in all the coconut countries is estimated not to exceed some thirty. Even this number may be reduced considerably if all the varieties were studied in the field in one place and the over-lapping ones are eliminated. Abnormalities and freaks sometimes called varieties are not to be included among the varieties proper.

Review of Literature: A few publications from important coconut countries are reviewed here:

Watt. (1889) mentions seven varieties of the coconut. He also states that "a small form is met with in East Africa that does not possess the fibrous pericarp". It is not clear what variety is meant. Perhaps he speaks of a dwarf with very thin husk. If so, such forms are well known in India. Barring this, the remaining six may be grouped into three distinct varieties viz., (1) the dwarf, (2) the ordinary tall and (3) the one bearing small nuts of the size of a turkey's egg. The fourth one "with heart-shaped fruit, pale-yellow colour, with an edible inner rind which turns red when the outer skin is removed" is possibly the one with sweet husk mentioned by various authors. The remaining two which are distinguished by their colour and shape of the nut can only be normal variants of the ordinary variety commonly grown in India. Hooker (1894) mentions of C. *nucifera* Linn. as the most commonly cultivated species and C. *nana* Griff, as a small low, variety grown in the Maldive islands and Ceylon. Trimen (1898) speaks of C. *nana* Griff, as "a verys mall-fruited dwarf sort going by the name of Maldive coconut". Here this dwarf variety appears to have been given the status of a species. It will be seen later that this is only a variety. He also speaks of a variety by name 'Tembili' with pink endosperm and called the king coconut. The name 'Tembili' is mentioned by Watt also but the colour of the endosperm which is unique in Trimen's 'Tembili' is not mentioned by Watt. The name 'King coconut' is given to the dwarf variety by other authors.

Ahmed Bin Haji Omar (1919) writes of the races of the coconut palm. He says that in the Singapore island there are twelve races differing in the characters of the nut and two in growth also. He mentions four races viz., Klapa Jatong, K. Bulat, K. Besar and K. Sepang from which copra is made in Singapore. K. Laga has too small a nut to be used in making copra. Two dwarf races viz., K. Puyoh (green) and K. Gading (yellow) are also included. K. Nipah is a promising high yielder but is not common. The shell of

K. Sekol is used for making cups. K. Wangi is said to have a 'peculiarly fragrant' endosperm and is medicinal. This unique coconut is also mentioned by Burkill (1935). He (Omar) has not described the races but has given photographs of the different nuts. The name Klapa or Kelpa meaning coconut is perhaps allied to Kalpa in Kalpa Vriksha (Paradise tree) a Sanskrit name for the coconut palm.

A Useful Dwarf Coconut: Handover (1919), and Jack and Sands (1922) have described a Dwarf Coconut called Nyiur Gading. It is a distinct small variety common in the Malay States, supposed to have been originally introduced from the Dutch Indies. Perhaps this variety first occurred as a mutant in Java. It is a small, hardy palm which begins to bear in about three years after planting. Bearing is profuse and the yield is said to be about 120 nuts per tree, per year. The thickness of kernel is good and the quality of copra is satisfactory. About 8400 nuts yield a ton of copra. The kernel is rich in oil and sweeter than that of the ordinary variety. Trees thirty years old, occurring in various parts of Malaya are said to be bearing profusely. Colour variants with yellow, golden, ivory yellow, green, brick red, green bronze and intermediate colours occur in the variety. The chances for self-pollination are more in this variety than in the ordinary one; 70—80 % or more of the progenies may breed true to type. This is the only dwarf grown on a plantation scale.

This useful variety may not be confused with other dwarf races or forms which go by different names—King coconut, Nicobar Dwarf, Laccadive Dwarf, Andaman Dwarf, Malay Dwarf, Chowghat (Malabar) Dwarf and Pathunettam-patta. These will be considered later. In fact, Nyiur Gading comes under the group of palms called semi-talls or medium dwarfs which are more hardy and robust than the true dwarfs, and have copra of good quality. The nut matures in about 11 months after pollination. The time of first bearing occurs in about four years after planting. The Tall X Dwarf or the Hybrid coconut evolved by the Department of Agriculture Madras, and the Ganga-bondam of the Circars (S. India) belong to this group of coconut palms.

Philippine Forms: Copeland (1931) in his book on the coconut has dealt with fourteen varieties occurring in the Philippines and the adjoining islands. Of these, five including Nyiur Gading already mentioned, are more important than the rest which include minor forms and freaks or abnormalities.

1. **The San Ramon:** This is a very high-yielding form with large nuts nearly twice as large as the ordinary, 3270 nuts giving a ton of copra. The yield is at times, said to be even 200 nuts per year. The distribution of the form ranges from Ceylon across Malaya and Polynesia. This is perhaps the largest nut found on a plantation scale. The large-sized nuts from Ceylon and the Kappadan of Malabar are allied to this form. From the account given the form is a very promising one for large-scale planting.

2. **The Lagana:** This is the ordinary tall variety, the most common and popular one typical of all the coconut countries of the world. About 6000 nuts are required to produce a ton of copra.

3. **The Coco-nino or the baby coconut:** This is a distinct, dwarf form with short trunk bearing in about four years after planting. It is a prolific bearer with rather thick and hard copra. About 100 nuts are produced by a single tree in a year. Some 7000 or more nuts are required to make a ton of copra. The form is specially valued for tapping and this is a promising one.

4. **The Pugai:** This is a very dwarf form fruiting in three years after planting. The husked nut is about 7 cms. in diameter and the husk is ? cms. thick. The nut is so small that it does not seem to be economical for large-scale planting.

These four varieties fall into two main groups viz., the Tall and the Dwarf. Besides the varieties described in the foregoing, Copeland mentions others viz., Makapuno, the Thyru Thengai (curd coconut) of Malabar which has the cavity filled with a firm tissue and is considered a delicacy. This is occasionally found in coconut plantations. The nut does not germinate when planted and produce a seedling. The Makapuno is an abnormality. Certain trees produce both the normal and the abnormal nuts. The normal ones from such trees when planted produce trees giving Makapuno nuts also. Lono nuts with soft kernel and Taban with sweet husk are also mentioned. Taban is known to occur in the Malabar coast also where it is called Kaiththali. There are other types also specially used for decorative purposes, or for their very thick or very thin shell or husk. The one called Lincoranag has a characteristic low habit of growth. Among the colour types the one called Agta is unique in having a dark green colour almost looking black.

Variety spicata: Jacob (1941) described a very distinct botanical variety called variety *spicata*. This is sometimes known as the spikeless coconut because the inflorescence is unbranched and is without the usual flower-bearing spikes. For the same reason it is called the Panamaram Thengai in Tamil, meaning the Palmyrah coconut. This variety is unique in that it is the only one in which femaleness is most expressed and maleness least expressed, because the number of male flowers is as low as 50, while in the ordinary coconut the number of female flowers is very much less than that of the male flowers viz., 25 and 600 (average) respectively. The setting percentage i. e., the number of nuts produced per 100 female flowers is very low. The mature nut is smaller than in the ordinary variety; otherwise the characters of the nut are the same. At the Coconut Research Station, Kasaragod (S. India), it was found that 50% of the progenies (natural) of variety *spicata* bred true to the mother. This variety was also found to cross freely with other coconut varieties. The resulting hybrids were vigorous. Variety *spicata* can be made use of in coconut breeding, but is useless for tapping.

The Male Coconut: Var. *spicata* is one extreme of sex expression. It is almost a pure female except for a few male flowers. On the other hand, there is a tree at Kasaragod which is completely a male. It looks very much like any other ordinary coconut tree but is more robust, especially the inflorescence. But it contains all male flowers only, some 5000 per bunch, and is never known to have produced any female flowers or nuts. Similar male coconut trees are said to be found in parts of Malabar. The separation of sexes in different individuals is no doubt a sign of advancement in evolution. But from an economic point of view a male coconut tree is not only unnecessary but undesirable, because it is a loss to the planter. This rare find was described by John and Narayana (1942).

The Hybrid Coconut: John and Venkatanarayana (1943) described the hybrid coconut. It is also called the Tall × Dwarf cross because it is obtained by crossing the ordinary tall variety with the pollen from the dwarf. The study of the hybrids on a field scale has been in progress during the last fifteen years at the Coconut Research Station, Nileshwar (Malabar Coast). The progenies are vigorous, with a short trunk and low habit. They

are early and prolific bearers; they first flower in four years after planting and the nuts mature eleven months later. Their performance has been satisfactory. The yield of nuts is high and the quality and quantity of copra are fairly good. A few seedlings obtained from the hybrids were planted in the field and it remains to be seen how they will do when they begin to yield. Even if the hybrid does not produce palms similiar to itself, it is not a serious drawback, because it lives for a sufficiently long period, and seed nuts to raise new hybrids have to be produced by artificial crossing. A number of inter-varietal, cyclic crosses between world varieties and forms are in the field. They are still too young to bear and it is too early to judge them. Still it may be said that hybridisation has opened a new line in the improvement of the coconut by producing new strains.

Freaks and Abnormalities: A dozen instances of abnormalities are mentioned by Patel (1938), and others in earlier years. These abnormalities are popularly, though incorrectly called varieties. They are, however, dealt with briefly in the following:

Poly-embryony: This is the phenomenon of a single coconut producing more than one seedling. The number may be two to four. More seedlings are produced on account of more embryos in the nut.

Branching Coconut: The ordinary coconut palm has only one growing poin which gives rise to a single unbranched trunk. Various authors have recorded instances of coconut trees with a number of branches.

Foliation of the Spadix: This is an instance in which the flower bunch, instead of producing flowers and nuts developed small branches which have subsequently dropped off.

Vivipary: Here the young female flowers instead of developing into normal nuts grew into bulbils or small seedlings, which however, when planted in the ground failed to establish themselves.

Suckering Coconut: This is a rare instance of a coconut tree producing suckers like a plantain. The tree is at Kasaragod (South India). A picture of the tree is given by Patel (1938) in his Monograph on the coconut. When separated from the mother and planted in the field the sucker gave rise to quite a normal tree.

Horned Coconut: At times one or two flat horns of varying sizes are found developing from the base of the nut. These are modifications of the staminode of the female flower.

Also instance of the pistillode of the male flower developing banana like structures have been recorded. Certain coconuts with semi-solid kernel, and others with sweet husk are already mentioned in the previous pages.

The freaks though interesting by themselves are not of any economic use; and most of them occur in all the important coconut growing countries.

Classification ot Varieties: The occurrence of different varieties and races in the various coconut growing countries of the world is well known. Most of them have been dealt with by authors as already mentioned. But a systematic classification of the known varieties does not seem to have been attempted. This is perhaps due to the fact, that the material to be handled is very difficult. Though certain varieties appear to be quite distinct, when considered by themselves, it is possible to connect up most of them except var. *spicata*, by a graded series of intermediate forms. This would naturally lead to considerable difficulty in defining the boundaries of any variety. Still it is necessary to separate the varieties as far as possible into definite groups and place them in their proper position. If not, the knowledge of the subject will tend to be confused. An attempt, therefore, is made in this paper to classify and name the outstanding varieties and forms.

The coconut is an important crop in South India and it has been studied by the Department of Agriculture, Madras, in its various aspects, during the last 33 years. The Department has maintained four Coconut Research Stations in the Malabar Coast, at Kasaragod, Nileshwar and Pilicode. With a view to studying the important world varieties, planting material was obtained in 1921 and 1924 from all the chief coconut-growing countries viz., Malay, Philippines, Java, Siam, Cochin-China, Ceylon and Laccadives, and planted it at the Coconut Research Station, Pilicode. The various economic characters of the varieties have been studied and the different forms are included in this paper.

The name variety is often used by many in the popular sense to include any variant whether it is a botanical variety, form or type. In the following account variety will be used only for botanical varieties, and races or forms and types will be denoted as such. From a study of the available material and perusal of the literature on the subject all varieties and forms can be broadly divided into two main groups viz., the tall and the dwarf. In each group there are number of forms. Eco-types of a form, such as heavy yielders and poor bearers are of local importance only and may not have much classificatory value.

The cosmopolitan species *Cocos nucifera* Linn., is divided into five varieties viz., var. *spicata* K. C. Jacob; var. *typica* Nar.; var. *nana (Griff)* Nar.; var. *javanica* Nar.; and var. *androgena* Nar. All these varieties cross with each other freely. Var. *spicata*

was already considered. Var. *typica* is the ordinary, tall variety, found in all the coconut countries of the world, and includes most forms some of which are named here as: *ramona, Kappadan, malayensis, siamea, cochin-chinensis, nova-guineana, gigantea, pusilla*, and *laccadive*. The large nuts from Ceylon and *Kappadan* from Malabar are allied to forma *ramona*, but the yield of nuts of these forms is less than that of *ramona* in the Philippines. Var. *nana* is the dwarf variety. and 'nana' is the earliest known name given to it. This includes all the pure dwarfs, and the forma *nana* (Coco-nino or baby coconut) and forma *maldiviana* (the Pugai of the Philippines). The first form has larger and economically more useful nuts, while the second has smaller ones. The Laccadive or Maldive Dwarf, the Andaman Dwarf, the Chowghat Dwarf, the Chennangi and the King coconuts etc., come under forma *maldiviana*.

Var. *javanica* is Nyiur Gading said to be originally a mutant from Java. It is intermediate between the tall and the dwarf varieties and is breeding true; economically it is important. As it is considered to be a mutant a separate varietal status is given to it. The Gangabondam and the hybrid coconut of Madras belong to this variety. A tall type of coconut recorded as 'Java' at the Coconut Research Station, Pilicode may not be confused with var. *javanica*.

Var. *androgena* is the male coconut palm. A purely male tree is a unique occurrence and it is here given a different varietal name.

Descriptions of Varieties and Forms: Var. *typica*. This is otherwise called the ordinary or the common Tall variety and is most extensively grown on a plantation scale in all the coconut tracts of India and elsewhere. Though the coconut is not said to be a native of India by botanists, the ordinary variety has been in cultivation in India from very ancient times and may therefore be considered for all practical purposes to be the indigenous variety.

It is a long-lived, hardy palm thriving under different soils, climate and rainfall, and is found in littoral sands as well as in table lands up to an altitude of about 3,000 ft. above sea level. It begins to bear in about eight to ten years after planting. Given sufficient soil moisture and plant food it grows well and lives to an age of about 80—90 years, and is fairly resistant to diseases and pests.

The stem of the palm, or trunk is smooth and erect and of medium girth of about 2 to 2½ ft. under rainfed conditions becoming stouter and more robust in irrigated and rich soils. The trees attain a height of about 50 to 60 feet or more. Every leaf axil of the bearing tree contains a spathe enclosing a spadix or branched spike. Female flowers which are only few are at the base of the spike and the numerous male flowers studded all over, occupy the rest of the spike. These open first and are shed in a period of nearly three weeks. Then the female flowers open and become receptive. Therefore the common occurrence in South India is that they are ordinarily cross-pollinated in nature, except in the summer months when there are chances for self pollination due to overlapping of spadices. After pollination, the nut matures in a period of twelve months, when it is fit for planting. Tender nuts are best obtained when they are about 5½ months old after pollination. The nut is medium sized varying in shape from spheroid to linear with colours varying from green, yellow and orange to shades of brown. The quantity and quality of copra are satisfactory. About 6,000 nuts yield a ton of copra.

There are many eco-types in this variety as heavy bearers, medium bearers, low yielders etc. The heavy bearers yield about 100 nuts per tree, per year under rainfed conditions. Early yielding, medium and heavy bearers are considered good for seed purposes. Alternate and irregular bearers are also met with in the variety; they give bumper crops in some years only, and are not selected for seed purposes.

The main forms of the var. *typica* are described in the following:—

1. Forma *ramona*: This form with large nuts and high copra content is described under the Review of Literature.

2. Forma *Kappadan*: The form is called Kappadan with reference to the large quantity of water contained in the tender-nut, (Kappadan = 16 bottles by volume). It is a form allied to the var. *typica* proper but is more robust in all characters, particularly in the size of the nut which is one of the largest on record. The shape of the nuts is broadly ellipsoid. The yield is rather low. Quantity of copra is high and copra is thick and hard.

This form is closely related to forma *ramona* and appears to have been naturalised in the West Coast and is met with in parts of South Malabar. The large nuts from Ceylon are similar to this form.

3. Forma *gigantea:* This is a form from the Andaman islands. As the name indicates, the form consists of palms with tall stature, massive proportions and majestic appearance. The nuts are round, green, and large; perhaps the largest on record. But the yield is poor, with only three or four nuts in a bunch. Though the copra content is high, the copra is thin and of poor quality. Water in the tendernut is plentiful and insipid in taste. The spathe did not yield to tapping and gave practically no juice.

First flowering occurs in about eight years after planting. It is not an economically important variety. The palms are resistant to diseases. The seed nuts give poor germination. A closely related type of this form, by name Andaman Ordinary is available at the Coconut Research Station, Pilicode. It is a good yielder of toddy. Nuts are big and similar in shape and appearance to those of forma *gigantea*. Stature is smaller than that of *gigantea*.

4. Forma *nova-guineana*: This is one of the forms of large sized palms. The palm is robust with a tall, stout trunk and a massive crown with large number of long leaves and bunches. The female flower production is high and setting percentage is rather low. The yield of nuts is fairly good being about 75 nuts per tree, per year. The nuts are medium-large, spheroid or ellipsoid in shape and green or orange brown in colour. The water in the tendernut is plentiful and sweet. Copra is thin and rather poor in quality. Percentage of oil in copra is low, being 66·2.

This palm comes to bearing in about seven years after planting. The form is unique in producing leaves and bunches in very quick succession. Sometimes two inflorescences open even on the same day especially in the summer months, while in var. *typica* proper the interval between the opening of successive bunches or inflorescences is about 25-30 days. This character contributes to high yield and is useful to the breeder. In its native habitat the form is said to produce one of the largest-sized nuts.

This form is susceptible to the attack of fungoid diseases, and pests.

5. Forma *cochin-chinensis:* The palm is robust with rather stout, tall trunk and large round crown well filled with large number of leaves and bunches. The bunches are large, full of fairly large-sized, spheroid nuts. The colour varies from green to shades

of brown. Female flower production is rather low but setting percentage is high. Tendernut has fairly large quantity of sweet water. The yield is high but the meat is thin; quality of copra is fair.

The palm comes to bearing in about eight years after planting. It is a useful variety possessing the desirable characters of high yield, medium-large size of nut and high setting percentage. The palms of this form are susceptible to the attack of fungoid diseases, and pests.

6. Forma *malayensis*: The palms of this form have a tall habit and the trunk is rather stout. The yield of nuts is low and the nuts are medium to large in size, green, and quite round or spheroid in shape. The water in the tendernut is sweet and plentiful with peculiar aroma about it. Copra content of nut is high and the quality is fairly good. The percentage of oil in copra is rather low. Female flower production is low and the setting is fair. The base of the button has a rose-ring seen clearly when the perianth is removed.

It is a late-yielding variety coming to bearing in about ten years after planting. It is highly susceptible to diseases and pests and there is fairly high shedding of buttons and tender nuts, but the form is good for tender nuts.

7. Forma *siamea*: This is an economically important form from Siam allied to forma *ramona*. The trunk is rather short and fairly robust with a good compact crown. The yield is medium, and the nuts are green, rather large-sized and ellipsoid or spheroid in shape. The water in tendernut is sweet and plentiful. The quality and quantity of copra are fairly good and the copra contains as much as 74·0% of oil. Female flower production is rather low and the setting percentage is moderately good.

The form is a late bearer beginning to yield in about ten years after planting. It possesses the desirable characters viz., good quality and quantity of copra and high percentage of oil, and is a useful form.

8. Forma *laccadive*: This form very much resembles the ordinary tall variety viz., var. *typica*, Female flower production and setting percentage are high. The nuts are medium sized, the quality and quantity of copra are good. Tendernut water is

satisfactory. The yield is high being above 100 nuts per tree, per year. It is a regular and heavy yielder of nuts. It gave the highest yield of toddy–twice as much as var. *typica.*

Economically it is a promising form on account of its high yield and good quality and quantity of copra. It will be worth while multiplying this form on a large scale in India.

9. Forma *pusilla:* This form resembles var. *typica* but is characterised by small-sized nuts and large bunches containing as many as 100 nuts or more in a bunch. The annual yield at times may be as high as 400 nuts per tree. Water or milk in the tendernut is very little and fairly sweet. The quality of copra is good though the quantity per nut is low on account of the small size of the nut. But the number makes up for the size. The form is unique for high female flower production and high setting percentage and yield-three important economic characters. Also the percentage of oil in the copra is very high, being 75%.

The shape of the nut is linear or spheriod according to the type. Spheroid nuts (unhusked) are at times very small being only of the size of a large orange. Then the number of nuts per bunch goes up to even 200. But the only drawback with the form is that it does not seem to be a regular bearer i. e. heavy yields are not regularly obtained every year. Still the average annual yield is high and the total out-put of copra per tree, per year is more than in var. *typica* or the ordinary variety.

It is an important, economic from useful in crossing as well as for large-scale planting, and is particularly prized for making ball-copra. Popularly the form goes by the name of "Divi" which means island possibly referring to the Laccadive and other islands where it is largely grown and from where the copra of this form is exported. It is occasionally met with in the West Coast gardens.

The size of the nut being small the quantity of kernel utilized for the production of seedling is much less than in any other variety, which means a considerable saving of copra.

The following are the forms of the Dwarf variety viz., var. *nana*:

1. Forma *nana*: The Coco-nino or the baby coconut of the Malay States is described under the Review of Literature.

2. Forma *maldiviana*: This is a popular dwarf form. It has a short trunk and small stature, with small crown and short leaves. The trunk is thin, attaining a height of about 10 to 15 feet with age. Rarely trees are said to live for more than 35 years. Being rather delicate, the variety thrives best in rich soils and under proper conditions of drainage.

On account of its early bearing nature people have a fancy to plant it in back yards of houses and it is now fairly common all over South India, where it is naturalised. The trees come to bearing in about three years after planting and the bunches practically touch the ground in the early stages of bearing and are pretty to look at.

The nuts are small sized and yield a fairly good supply of sweet milk or water in the tendernut. But the copra is thin and of poor quality being leathery. It is therefore not met with on a plantation scale in India. It is also susceptible to the attack of pests and diseases.

Unlike in var. *typica* there are chances for self-pollination due to overlapping of of male and female phases of flowering. The nuts mature in about ten months after pollination i. e., two months earlier than those of var. *typica*. Also the leaflets in the seedlings split much earlier than in the seedlings of the var. *typica*

There are two types in this form. One type has very small narrow nuts with very small quantity of copra. The other has fairly large or medium sized nuts and these should be preferred for planting. Colour forms viz., green, yellow and orange or red and brown are common. These are ornamental. This variety when crossed with var. *typica* (mother) gives rise to progenies with hybrid vigour.

The various forms have been named after the country from which they were originally obtained or where they are largely grown, or after a distinguishing character of the form.

The data relating to the measurable characters of some of the varieties and the forms are furnished in the table appended, which will give a comparative idea of their economic characters. The relative sizes and shapes of the cut and the unhusked nuts are figured in two plates.

A separate key for the identification of the varieties and forms is also included.

Uses of the Varieties and Forms: The uses of the coconut are many and varied. Practically every part of the tree and the nut is put to some use or other. Most books on the coconut deal with the many purposes for which it is utilized. The most important commercial product is the copra or dried kernel. For a planter the main consideration is the production of the best quality of copra at a low cost. The output of copra per tree, per year contributes to the yield of plantations. This depends upon the number of nuts each tree bears in a year and the quantity of kernel contained in the nut. The large size of the nut alone does not count, because in the poor soils of South India, the yield of nuts goes down as the size increases. Based on these considerations the best variety for this country is the var. *typica* or the ordinary tall as also forma *laccadive.* The best planting material has to be rigorously selected from among promising eco-types. The *laccadive* form is in fact better than var. *typica,* but planting material is not available on any large scale. There are only a few trees at the Coconut Research Station, Pilicode and attempts have to be made to multiply the form on a large scale for distribution. The form called *pusilla* or Laccadive Small as it is called popularly, is quite good from the view point of copra production. But as the size of the nut is small, the husking and breaking charges to produce a unit weight of copra may be comparatively higher. It is a form specially suited to make ball copra which is much in demand in certain North Indian markets. The percentage of oil in this form is the highest on record in the Madras collections.

In this context, the famous San Ramon nut (forma *ramona*) is worth considering. It yields twice as much copra of good quality as the var. *typica* proper of India. The yield of nuts also per tree is quite high. If this form can do as well in India as it has done in Philippines it should be easily possible to double our output of copra per acre. But unfortunately, it does not seem to have been given any large-scale trial in this country. Also the Pilicode collections are lacking in this important form. The Nyiur Gading or forma *javanica* of the Malay states, which is an early bearing, heavy yielder appears to be promising on a plantation scale, but it has not yet been given a proper trial in India. It will be worth

while introducing these two forms and study their performance carefully in the different coconut tracts of the country, before contemplating large-scale planting.

From the view point of production of sweet toddy for jaggery (gur) making, the forma *laccadive*, the type Andaman Ordinary and the form *pusilla* are the best yielders. Among the dwarfs, forma *nana* is reported to be a high yielder of juice. For the coir fibre forma *laccadive* is good. For ornamental purposes the dwarf types are the best. They have a short stature and well-filled bunches of nuts with different colours as ivory, orange and apricot, almost touching the ground, and make pretty palms in any garden. Among the ordinary tall variety there are certain trees which produce undersized nuts with thicker shell than the normal and these can be used for carving and shell work.

The different varieties, and forms afford a wealth of material for the coconut breeder whose ideal is an early bearing, high yielding palm with large nuts having superior quality of copra and high percentage of oil. And high yield is the resultant of quick production of flower bunches with large number of female flowers with high setting percentage. The palms should also be resistant to pests and diseases. The breeder's ideal can not be achieved by selection alone, as the different economic characters are distributed among the various varieties and forms and recourse should be had to crossing. Fortunately all the varieties and forms cross freely with one another and they can be utilized to produce new and useful, economic strains.

Introduction of Varieties: Reading of the many varieties one may be naturally inclined to get outstanding varieties from foreign countries. In this respect particular caution should be exercised especially when large-scale planting is contemplated. Because all varieties are not cosmopolitan, which means that they will not do equally well in different countries, as the conditions of soil and climate vary considerably from country to country. Also, it should be remembered that in most varieties cross-pollination is the rule, and the progenies may not breed true to the parent (mother). The object of introducing a new variety should be clear—it may be for increase output of copra, or toddy for jaggery making or for ornamental purposes. It is important to ascertain, before importing foreign varieties, whether similar or nearly similar varieties are already available in the country. A variety which has done well in a foreign country need not do equally well in this country. The

famous San Blas coconut of Panama which is very productive proved disappointing when it was introduced into the Malay States. Most of the imported varieties grown at the Coconut Research Station, Pilicode (Malabar Coast) did not come upto expectations. Many of them were highly susceptible to the attacks of pests and diseases, particularly shoot rot. The size of nut went down and the quality of copra was inferior in many instances. Such risks private planters cannot take and it is best to leave the introduction of foreign varieties to the Coconut Research Stations, which should be in a position to conduct proper trials, and advice the public regarding the best material and variety suitable for planting. Also while introducing new varieties the risk of introducing diseases into a healthy tract should be seriously considered and guarded against.

Summary: The paper deals with the varieties and the forms of the coconut. The information available on the different sorts grown and studied at the Coconut Research Station, Pilicode, and that gathered from publications dealing with the subject from various coconut growing countries is included. A systematic classification of the available material has not been attempted by previous authors, and it is done in this article. The species *Cocos nucifera* Linn, (the coconut) is divided into five varieties, of which only one has been hitherto described. All the varieties fall into two main groups viz., the Tall and the Dwarf. In the Tall groups, three varieties and nine forms and in the Dwarf two varieties and two forms are recognized; these now bear new names, which are mostly after the names of the countries from which they were obtained. The ordinary, tall variety which is typical and cosmopolitan in all the coconut growing countries is called var. *typica*. The many types of local importance found in various countries are not emphasized upon. Descriptions of the varieties and forms and a table of their quantitative characters are given, as also a key for their identification. The importance of outstanding forms like the Laccadive nut, and the famous San Ramon from the Philippines is brought out. The dwarf mutant, here named as var. *javanica* and spoken of as a good performer is recommended for trial. The rare find of a purely male coconut tree which shows the direction of evolution of the coconut species is christened as var. *androgena*. Varieties or forms for special purposes like commercial planting, or for tapping or for ornamental planting etc., are mentioned. The possibility of evolving new and economically useful strains by hybridization is indicated.

It is, however, not claimed by the authors that the work of study and classification of the many varieties and forms of the coconut is either complete or comprehensive, and much remains to be yet done on the subject.

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KEY FOR THE IDENTIFICATION OF COCONUT VARIETIES AND FORMS

Varieties

A. Inflorescence unbranched or rarely with one or two small spikes ... var. *spicata.*

A. A. Inflorescence normal and always branched

B. Tall, late bearing palms

C. With both male and female flowers ... var. *typica.*

C. C. With only male flowers ... var. *androgena.*

B. B. Dwarf and early bearing palms

D. Vigorous palms bearing in 4 years ... var. *javanica.*

D. D. Delicate palms bearing in 3 years ... var. *nana.*

Forms of var. *typica.*

A. Nuts very small (about 1000 cc. in volume) and very many in a bunch—even 100 or more .. *pusilla* (Laccadive small)

A. A. Nuts not small

B. Nuts very large (7000 c, c.), majestic palms, copra content low and quality inferior ... *gigantea* (Andaman giant).

B. B. Nuts medium large (about 6000 c. c. or less)

C. Nuts about 6000 c. c., copra superior and quantity high—about 10—12 oz. per nut

D Yield of nuts per tree, per year, about 100 even ... *ramona.*

D. D. Yield of nuts low about 35 per tree, per year ... *Kappadan.*

C. C. Nuts 4000 c. c. in volume or less

E. Trunk robust—90—100 cms. in girth

F. Percentage of oil in copra high (74) ... *siamea.*

F. F. Percentage of oil in copra low (66—69)

G. Female flower production (annual) very high (744) ... *nova-guineana.*

G. G. Female flower production (annual) low (220) ... *malayensis.*

E. E. Trunk of medium girth (73—83 cms.)

H. Copra thin (0·82 cms.) and % of oil in copra low 66 ... *cochin-chinensis.*

H. H. Copra thicker (1·2—1·3 cms.) and percentage of oil high 72 ... *laccadive.*

TABLE

The quantitative characters of the coconut varieties and forms—Coconut Research Station, Pilicode

Serial Number	Variety or Form	Age of tree	Age at first flowering	Girth of trunk at base	Number of leaves in the crown	Length of leaves	Length of petiole	Mean production of female flowers per year	Highest yield of nuts recorded per tree in a year	Quantity of water in tender nut	Weight of unhusked nut	Weight of husked nut	Volume of unhusked nut	Volume of husked nut	Mean thickness of meat	Thickness of husk (Middle of husk)	Mean copra content per nut	Percentage of oil in copra (Ether extraction)	Yield of juice per day, per palm	Serial No.
		Year.	Year.	Cms.		Cms.	Cms.			C.C.	Grams.	Grams.	C.C.	C.C	Cms.		Cms.	Grams.	C.C.	
1.	Var. *typica* ...	25	10	73	34	594	129	320	80	300	1134	454	2264	465	1·21	2·45	159	71 6	899	1
2.	Forma *laccadive* ...	16	4	76	39	533	137	648	160	290	1219	510	2170	500	1·25	3 04	157	72·2	1758	2
3.	" *pusilla* ...	16	6	91	30	526	144	522	400	261	709	225	1200	250	1 12	1·40	60	75 3	1234	3
4.	" *Kappadan* ...	...	..	...	...	...	...	...	35	894	1929	193	5750	1135	1·48	4·30	332	61·7?	...	4
5.	" *siamea* ...	15	10	93	32	487	132	175	59	841	1899	737	3915	855	1·10	3 60	221	74·3	41	5
6.	" *gigantea* ...	16	8	114	38	579	152	199	35	500	1786	878	6900	800	1·29	6·30	180	67·1	Nil	6
7.	Type Andaman Ordinary ...	16	7	91	31	533	144	451	40	377	1701	552	3640	700	1 28	3·70	170	67·1	1339	7
8.	Forma *nova-guineana* ...	15	7	91	31	579	152	744	93	348	1105	368	3600	580	1·12	5·20	213	65·6	541	8
9.	" *malayensis* ...	15	10	91	29	465	114	220	44	609	1616	935	3200	996	1·22	2·40	200	69·0	680	9
10.	" *cochin-chinensis* ...	15	8	83	30	609	137	208	88	464	1162	652	2340	750	0·82	2·30	140	66·2	758	10
11.	" *maldiviana* ...	15	5	71	27	396	106	140	86	348	623	317	1053	450	0 96	1·55	84	66·2	310	11
12.	Var. *spicata* ...	8	4	78	30	513	134	978	25	210	510	283	1950	500	1·25	2·10	141	70·6	Nil	12

(Note: 1 oz. — 28·35 grams): (1 Fluid ounce — 28·41 C. C.)

PLATE 1
VARIETY AND FORMS OF COCONUT
NARAYANA & JOHN

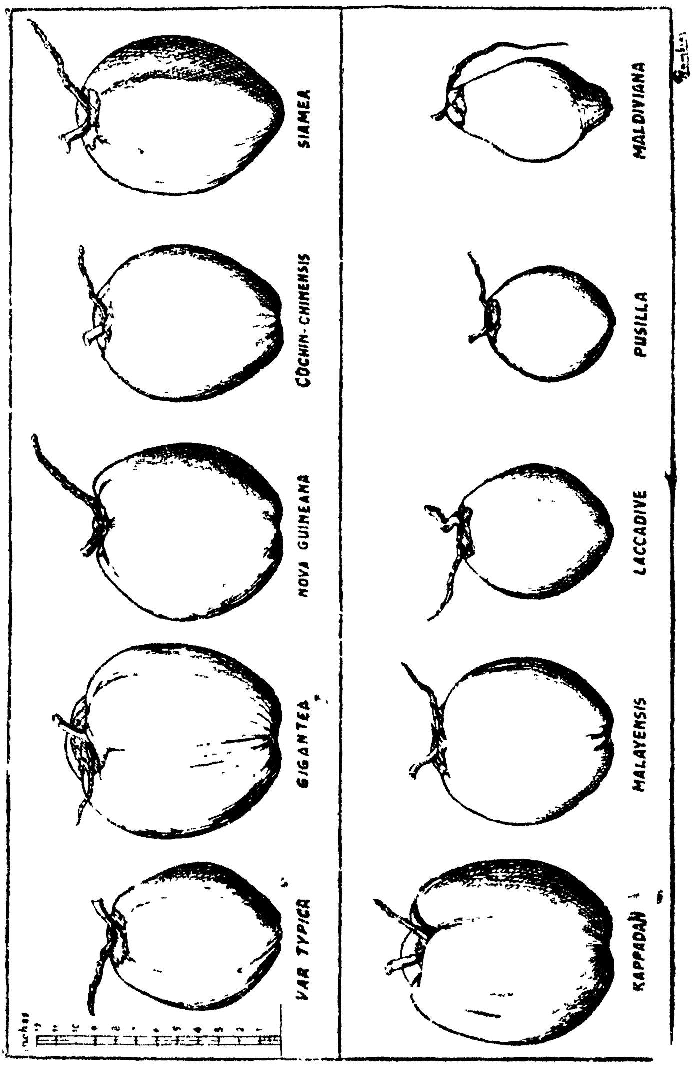
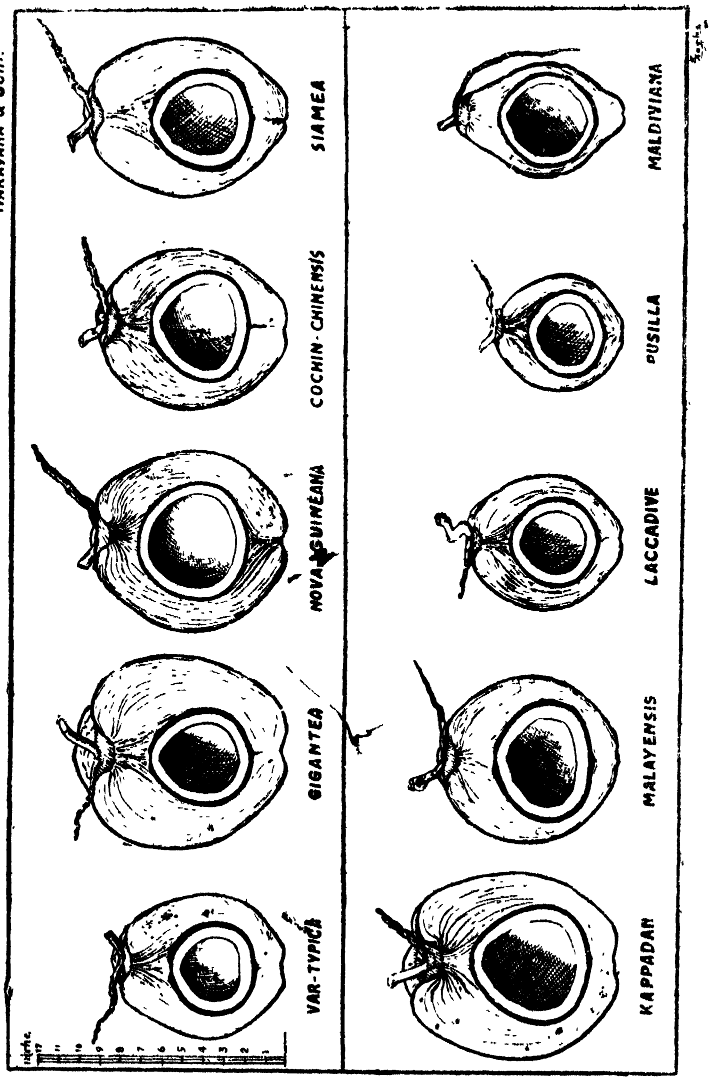


PLATE 2

VARIETY AND FORMS OF COCONUT (CROSS SECTION)



NARAYANA & JOHN

Turmeric Survey

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Turmeric is cultivated in garden lands as well as wetlands to the extent of about 3,100 acres in Coimbatore District in the vicinity of either a river or its channel. The three important taluks growing turmeric are Bhavani, Gobichettipalayam and Erode which constitute about 850 750 and 1,500 acres respectively. This area is not constant and it varies with the fluctuations in the price of turmeric in the Erode market. The crop is cultivated in about 2,000 acres in Karur taluk (Thiruchirapally District) and a small area in Salem District and the entire produce is marketed in Erode which exports the cured product to all places in the Presidency and also to places outside India through commission agents in Calcutta, Karachi, Colombo, Bombay and Madras. The produce from Valliyampalayam area in Gobichettipalayam taluk is valued highest and considered to be the best among the produce received from different centres. The crop is valued as a dye-stuff in the foreign market apart from its demand as a condiment and use for medicinal purposes. The cultivation and yield vary with the nature of the soil, irrigation, water, kind and availability of manure and also upon the skill of the cultivator.

Soil: Turmeric is mainly cultivated in well-drained red alluvial soils with ample facilities for the application of silt having plenty of organic matter, as Bhavani river silt. But it is also grown in heavy black soils as in Paruvachi in Bhavani taluk and Pasupathipalayam in Karur taluk. In heavier soils plenty of organic matter is applied to permit development of rhizomes by aiding drainage.

Rotations: No uniform rotation is followed in this tract in the cultivation of the crop. In the garden lands of Gobichettipalayam taluk the common rotation is as follows :—

1. Turmeric (May—June), 2. Fodder Cholam (February—April), 3. Arisi Cumbu (May—July), 4. Late Ragi (July—October), 5. Late Cotton (October—March), 6. Turmeric (May—June).

In Bhavani taluk either the above rotation or the following is adopted :—

1. Turmeric (May—June), Fodder Cholam or Panivaragu (February—April), 3. Arisi cumbu (May—July), 4. Ragi (July—October), 5. Sunhemp (Green Manure) (February—April), 6. Turmeric (May—June).

In wet lands of Erode taluk the usual rotation that is followed is as below :—

1. Turmeric (May—June), 2. Fodder cholam (February—April), 3. Samba Paddy (July—January), 4. Sunhemp for green manure crop (February—April), 5. Turmeric (May—June).

Season: The season for sowing the crop ranges from May—July depending on the receipt of water in the channels. In places where lift irrigation is done from Bhavani river like Kadayampatti, Thippichetti-palayam and Oricheri they are all planted earlier. But in Erode and Bhavani taluk planting is done rather late.

Preparatory Cultivation: After the harvest of the previous crop the land is ploughed under optimum moisture conditions not less than six times until a fine tilth is obtained. As previously mentioned if a thick-sown crop of Sunnhemp is in the field, raised for green manure the tops are cut to facilitate subsequent ploughing in. The seed rate used is about 60 lb. per acre. Generally country ploughs are used but big ryots who are having stronger animals also use various mould-board ploughs like Cooper 11, 25 and P. S. G. 10.

Manures and manuring: As the value of silt in the cultivation of this crop is well appreciated by all turmeric cultivators there is severe competition for securing the same. To the extent availale silt is applied up to 150 cart-loads per acre. In places like Appakudal and Vempathy in Bhavani taluk the silt accumulated in the tanks in the respective villages is utilised as manure for turmeric. These tanks receive their water supply from jungle streams passing through Bharghur hills and hence carry with them a lot of vegetable matter. In places where the soil is heavier, groundnut husk, rotten palmyra leaves from old roof-tops, kolinji plants cut into bits, cumbu straw which becomes unfit for cattle fodder are also used. Cattle manure, muncipal rubbish and nightsoil compost are also used at 30—50 cart-loads per acre. Ryots apply heavier doses of manure in light red soils as they are considered to be hungry soils while the heavy clay soils which are considered more fertile receive a lesser dose of manure. It is said that sheep-penning leads to more of vegetative growth and less of yield in turmeric. Some of the ryots in Sinnapuliyur of Bhavani taluk gave their opinion that cattle manure without the admixture of silt in heavier clay soils leads to the attack of termites. Growing sunnhemp as a green manure crop 1½ months prior to sowing of turmeric and ploughing it in at flowering stage is becoming more and more popular and this lessens the quantity of manure applied to the crop by about 25 cart-loads per acre. In Bhavani taluk some ryots have used groundnut cake at 480 lb. per acre and ammonium sulphate at 112 lb. per acre and obtained very good yields. In Karur taluk on heavier clay soils, an application of 750 lb. of castor cake and 112 lb. of ammonium sulphate per acre did not give any appreciable increase in

yield over the local custom of applying organic manure. In Vellalapalayam village of Gobichettipalayam taluk, superphosphate has been reported to give good yields. In Erode taluk ryots have realised the value of municipal compost and on account of the keen competition it is found to be costlier than cattle manure. In general it is noticed that the value of organic manures and addition of silt is uniformly appreciated by turmeric cultivators in this district.

Seeds and Sowing: The seed material used is always selected from the previous year's crop. They are sold in terms of basketfuls or "Sadus" the capacity of the basket varying from 16 Madras measures to 32 Madras measures. In Karur the capacity of one "Sadu" is only 16 Madras measures weighing 60 lbs. Twenty-eight such "Sadus" are required per acre for sowing. In Erode taluk one Sadu is 32 Madras measures and in Bhavani it is 24 Madras measures In all other taluks except in Gobichettipalayam the harvest of the crop of a small portion is left for seed purposes. Just after a month after the removal of the main crop the stalk of the seed material crop are cut and irrigated twice at fortnighly intervals. Then the seed crop is dug out and the rhizomes collected and preserved on dry sand and covered by dry leaves of turmeric. Only healthy ones free from diseases are selected for seed purposes. Rhizomes which are too thick otherwise called "Periyanadam" are rejected because they shrink very much after being cured. Both the round ones as well as the fingers are used as seed material, but they are sown only separately. Though the round ones are sold at Rs. 30/- less per ton than "fingers" in Erode market the ryots still use only a small percentage of the same as seed material. The ryots could not satisfactorily explain as to why the "round" ones or the mother rhizomes which are cheaper than the "fingers" should not be used as seed material. Ryots in Gobichettipalayam taluk are of opinion that "round" ones are able to produce vigorous growth of plants but give less yield. In Bhavani and Erode taluks the ryots believe that round ones produce vigorous plants and also result in good yield, but the seed material cannot be preserved for a longer time as in the case of "finger" rhizomes. In Karur taluk the ryots say that the round ones are able to come up well in heavier soils and hence suitable only for such soils. The majority of ryots seem to be of the idea that round ones may be preferred to "fingers" as seed material, but the matter needs investigation. About 1500 - 1800 lb. of seed material will be required per acre.

Method of Sowing: In well drained soils of Bhavani and Gobichettipalayam taluks planting in beds is preferred to planting in ridges. It is found that the number of plants in bed system is always greater than when planted in ridges and according to the ryots the total yield per acre increases as the number of plants increases up to a certain limit. In Erode and Karur taluks, when the soils are either heavier or irrigation is done by

direct flow from the channels, the size of the beds varies with the source of irrigation. Usually, they are 8′ by 8′ feet. In the case of ridges it is 1½′ to 2′ in lighter soils and 2—2½′ in the case of heavier soils. When the ridges are formed 2½′ apart they are bigger in size and rhizomes are planted in 2 rows on both sides of the reidges while in smaller ridges they are sown only in one row at the crest. The method of sowing is almost the same in all places except in Sinnadharapuram where it is simply dibbled by the hand in the ridges 1 foot apart. In other cases a cut is made on the ridges with a mammoty and is slightly lifted and the turmeric fingers broken to 2″ bits thrown into the pit one at a time so that when the mammatty is taken out the soil will cover the seed material completely. The distance between the seeds in the ridges or in the beds will be about 10 inches. Thus for sowing 1 acre 5 men to dig and 5 women to sow the seed-rhizomes and 2 men to level or reform the ridges respectively will be required.

Other crops sown as mixtures: Turmeric is rarely raised as a pure crop. Castor is commonly grown as a minor crop just for giving shade to the turmeric crop and a handful of seeds is sown here and there soon after the turmeric is planted. The other crops which are also grown as a mixture are the following:— Cumbu, Ragi, Maize, Onions, *Sesbania egyptiaca* and *Colocasia*. After turmeric rhizomes are sown, cumbu seedlings or ragi seedlings are planted one foot apart in September when the rhizomes begin to have vigorous growth. In the case of maize the seeds are sown 1½ to 2 feet apart and the cobs are sold while green and the entire crop is removed within 80 - 90 days after planting. On the same day or a day after the sowing of turmeric, onions are planted on the ridges on both sides 1′—1½′ apart and 600 lbs. of seed bulbs are generally required per acre. It is also usual to plant seedlings of chillies, brinjals, tomatoes and other vegetables on the bunds of main channels here and there just to give a subsidiary income to the ryot for meeting the cultivation expenses. Some of the ryots feel that by growing these minor crops as a mixture the main yield is not affected while others believe that the yield of the main crop is reduced thereby. Adverse effects are reported to be variable with different crops. For instance the cultivation of maize is reported to reduce the yield of turmeric considerably while onion does not affect it so much.

Irrigation: Ryots always feel that maximum yields of turmeric are obtained in well-drained soils and that too under lift irrigation. In places where water is irrigated by direct flow there is a tendency for over-watering and the soil becoming ill-drained and hence according to the ryots a lower yield is got in such places. Irrigation is done at longer intervals in the earlier stages of the crop and become more frequent, even twice a week from the fourth month after planting, when the rhizomes begin to make vigorous growth.

After-cultivation: Weeding with a hand hoe twice, the first, two weeks after sowing and the second 1½ months after sowing are done. The crop is hoed with mammoties and plants earthed up once, after the harvest of minor crops like cumbu, maize, ragi, or onions and another after the fourth month when the rhizomes begin to grow vigorously.

Harvest: The crop becomes ready for harvest eight months after planting when the rhizomes and the leaves are fully mature and the leaves show a tendency to turn brown. The stalks are harvested flush to the ground level soon after irrigating the crop. Subsequently two more irrigations are given once in two weeks and the rhizomes are dug out either by means of a mammoty or a tool called "Kothu" in Tamil. About 40 men will be required for digging the entire produce from an acre and 120 women to clean the rhizomes free of mud, to remove the rootlets, and also to separate the mother rhizomes from the stalk, to sort out fingers and rounds and put them into separate heaps.

The turmeric thus harvested is boiled in rectangular pans made of 12 G. M. S. plates. They are $3' \times 2' \times 1\frac{1}{2}'$ in size usually, though the size varies slightly in some places. Rectangular pits 3' in depth and of the same dimensions as the pans, are dug and they form the hearths on which the boiling is done. The pans are placed on two iron plates, generally worn-out cart tyres, placed lengthwise on the hearth on the borders. Loppings purchased on contract for the purpose are used as fuel. The pan is filled up with turmeric to be cured, a bucket full of cowdung water and equal quantities of fresh water are added and the surface is covered by means of a moist gunny. Castor stalks and *Sesbania egyptiaca* twigs got from the subsidiary crops in turmeric are also used as fuel for boiling turmeric rhizomes. When white fumes are seen from the gunny or when a broomstick passess into the rhizomes by mere pressure, it is taken that the boiling is complete and the pan is immediately removed and emptied on the threshing floor. The heaps are then spread uniformly, to be dried in the sun for about ten days until the whole stuff is completely dried. A pan can hold about 150 lbs. of green turmeric and when cured and dried it will weigh about 35 lbs. Four men with two pans can cure to get about 7 sattais or 1960 lbs. of cured stuff in one night, working for 6 hours.

Polishing: This is done either by means of a basket or by means of turmeric polishers invented by the Department. New bamboo baskets of 16 Madras measures capacity are hung to a horizontal post just above our head by means of a rope tied at the rims in 2 places in a line passing through the centre. Dried turmeric is taken about two-thirds full in the baskets, a few small stones are also added and 2 women one on each side standing and holding the baskets shake it up and down alternately so that the turmeric rhizhomes coming in contact with the rough surface of the basket as well as the stones get themselves polished. Two women working thus for 8 hours can polish 420 lbs. of cured stuff per day. In

the case of a turmeric polisher 5 men can polish 10 "pothis" or 2,800 lbs. of cured rhizomes in a day. Of course polishing by means of the improved polisher is cheaper and more efficient but the demand for the machine is so great that all are not able to procure the same. The Co-operative Sale Societies, and the Agricultural Depots in taluks are issuing the same on hire to the ryots but the number here is too inadequate. On enquiry it is seen that many ryots are prepared to purchase the implement for themselves.

Marketing: The polished stuff is packed in gunnies without being exposed to the sun lest the polish be affected. Erode is the main marketing centre for turmeric. The entire stuff of Coimbatore District Karur, Salem and sometimes produce from Cochin State are all exported from Erode to various places. There are nine wholesale merchants who purchase the turmeric and sell it to various merchants within the country and also export it to foreign countries through commission agents at Karachi, Bombay, Calcutta, Madras and Colombo. There are a number of commission agents at Erode and Karur who undertake to sell the ryots' produce to the merchants at Erode on a commission of 0–1–0 per rupee worth of produce sold. The Co-operative Sales Society at Gobichettipalayam with its branch office at Erode also undertakes to do the same on a commission of 0–0–10 per rupee but the ryots prefer to sell their produce through private commission mundies than through the Co-operative Sales Society for the following reasons:

1. The private mundies advance crop loans to the ryots at the rate of Rs. 600 — 800 per acre of turmeric crops to be raised without much difficulty or formality while the Society cannot pay more than Rs. 300/- and that too not so easily.

2. Though the commission is more and ultimately other expenses by way of presents in kind are always more in a commission mundy, yet the ryots find it easier and more convenient. A quick disposal of the produce in consultatiou with the ryots tempts the ryots to sell the produce through these commission mundies in preference to Co-operative Sales Societies.

The following are the various stages in the marketing of turmeric by a ryot through a commission mundy at Erode.

1. The ryot takes the produce to the Commission mundy packed in gunnies already supplied by the merchant free of hire, and stores it in the mundy.

2. A handful of the sample is taken by the commission agent and various merchants are approached along with the producer and he finds out the price at which the particular stuff could be sold. If the ryot is prepared for the price offered by the merchant, the whole thing is sold to the merchant at that price.

3. Before the weighment is made the round ones that may be found mixed with finger rhizomes are all picked out on a contract rate of a few annas per bag of 140 lbs. and the stuff is weighed. If any stones are found mixed with turmeric the weight of stones found in one maund is deducted at a flat rate from the entire weight of produce.

4. About 40 to 50 lbs. of turmeric for every 2,800 lbs. of produce will be given free towards the *Kalas* charges though the Commission agent also gets a portion of the same.

5. While the bags are being taken into the mundy or loaded in the cart the fingers dropped here and there will all be collected and stored by coolies specially employed by the Commission Agent and over which the ryots do not have any claim.

6. When the total value is worked out in addition to the usual commission at 0–1–0 per rupee, other deductions like "mahimai" "Dharmam" etc., are also made at a few annas per 280 lbs. of turmeric sold.

In the case of the Sales Society, in addition to the Commission they charge 0–2–0 per "sattai" or 280 lbs. towards kalas charges. There are no other deductions made. The round ones are purchased by the Commission Agents alone, always at a price Rs. 30/- per "sattai" less than that of finger rhizomes. Fingers which are uniformly thick, smooth, long and cylindrical, and which when broken, break with a sound and show a dark yellow colour are considered best and fetch the maximum price.

Preparing for Export: The produce purchased by the wholesale merchant at Erode is further prepared for the market. Nearly 75,000 bags of turmeric are being purchased at Erode by the merchants out of which 60,000 bags are from Erode, Bhavani and Gobichettiplayam taluks. About 12,000 bags are being received from Karur and 3,000 bags from other districts. The quality of the produce is different from place to place and one can easily identify the produce from a particular locality. For instance, the produce from Gobichettipalayam taluk will be long round, branched, smooth and breaks with a metallic sound. The Karur stuff is dull in colour. short, bent and always fetches Rs. 30/- per "pothy" of 280 lbs. The turmeric fingers from Salem are, thick, slightly shrunken and long. Alwaye turmeric is short, straight, sharp at both ends and is said to be superior for the manufacture of dye. But all these qualities are not always constant. Depending upon the demand from particular markets the produce from particular localities are sold at a high rate. For instance though Salem produce is purchased at a relatively cheaper rate at Erode it is sold in some years at Karachi for highest prices. Though the rounds are always purchased Rs. 30/- less per "pothy" than fingers, yet there have been years when the former has been, sold for foreign countries at a higher price than the latter.

So also different markets require different kinds of treatments of the stuff purchased by the merchants at Erode. For instance the produce sold at Karachi and Bombay has to be dry-polished for a second time in a power-driven polisher before it is exported and packed in gunnies of 96 lb. nett. When selling the produce through Calcutta the produce is given a colouring. Two Madras measures of turmeric powder got by powdering round rhizomes is mixed in 20 gallons of water and the coloured solution is sprinkled over turmeric taken in a basket and shaken constantly when the entire produce gets completely coloured. They are dried under shade and packed in gunnies of 164 lb. nett. By the former method there is a decrease in weight of 7 lb. for every 280 lb. and by the latter method there is an increase in weight by about 14 lb. per 280 lb. For turmeric sent to other places within India no other treatment is given. Though there are merchants at Erode who have ample facilities for trading with merchants in foreign countries they are only selling the produce through commission mundies at Karachi, Bombay, Calcutta etc., paying Rs. 2/- to Rs. 2—8—0 per Rs. 100/- because they are not able to supply to the foreign merchants at a specified time large consignments of quality for the following reasons:

1. The produce of different ryots varies in quality and produce of the same quality is not received all at one time.

2. The ryots do not sell their produce to the same merchant every year.

3. The quality of different localities varies considerably.

4. Facilities are not available for keeping the produce for a longer time in the godowns without being attacked by insects.

The ryots who are not able to sell their produce in the same year generally preserve the produce underground.

Pests and Diseases: The damage caused by insects to turmeric is negligible, but the leaf-spot disease which in some cases does great havoc is very important and worth mentioning, According to ryot is the disease is severe in years of drought. The ryots have realised that use of healthy seed material always produces encouraging results.

Land Tenure System: In Coimbatore District, when turmeric is cultivated in garden lands on lease system, the tenants have to pay at 5—6 pothies (280 lb. for pothy) of turmeric per acre per year or Rs. 300/- per acre. In wetlands in Erode taluk 6 to 8 pothies (192 Madras measures per pothy) of paddy per acre per year is common. The yield of the crop is about 18 sattais or 3,240 lb. per acre in Gobi, 4,000 lb. in portion of Bhavani and 2,7000 lb. in Erode and other places.

Cost of cultivation for one acre of turmeric in Coimbatore District:

	M.D.	W.D.	C.D.	B.D.	Rs.	A.	P.
Preparatory Cultivation:							
Ploughing 6 times	8		4	8	24	0	0
Manures and Manuring:							
Carting Farmyard manure and Silt from the yard. ...	6			4	14	0	0
Spreading manure. ...	4				4	0	0
Covering manure. ...	1½			1½	4	0	0
Cost of 50 cartloads of farmyard manure at Rs. 4 per cartload. ...					200	0	0
Cost of 100 cartloads of silt at 0—8—0 a cartload. ...					50	0	0
Seeds and Sowing:							
Forming ridges and furrows with country plough and reforming with mammoties. ...	5		1¾	1	7	0	0
Cost of 20 Sadus of seed rhizomes at Rs. 15/- per Sadu					300	0	0
Sowing and reforming ridges	8	4			10	0	0
Dibbling onions—8 bags at Rs. 6/- per bag. ...		16			56	0	0
Irrigation:							
40 irrigations at Rs. 12/- per irrigation. ...					480	0	0
After Cultivation:							
Weeding by means of hand hoe. ...	20				10	0	0
Mammoty weeding and earthing up. ...	24				24	0	0
Harvesting onions. ...		40			20	0	0
Cutting turmeric stalks. ...		4			2	0	0
Harvesting rhizomes. ...	20	60			50	0	0
Curing turmeric. ...	8	3			9	8	0
Watch for 10 days. L. S.	10				5	0	0
Hire on boiling pan at 0—8—0 for three days. ...					1	8	0
Polishing. ...	10				10	0	0
Hire charges at Re. 1/- for 2 days. ...					2	0	0

Marketing:	M.D.	W.D.	C.D.	B.D.	Rs.	A.	P.
Transporting to market at 0—8—0 per bag for 40 bags.					20	0	0
Kalas at 0—2—0 per bag.					5	0	0
Lease 5 pothies of turmeric at Rs. 140 per pothy. ...					700	0	0
Fuel ...					40	0	0
					2,048	0	0

Receipts:

Cost of 20 sattais of turmeric at Rs. 140/- per pothy. ...	2,800	0	0
Cost of 20 bags of onions at Rs. 6/- per bag.	120	0	0
	2,920	0	0
Net profit per acre.	872	0	0

The hire for 1 pair of bullocks is charged at Rs. 3 per day.

The hire for 1 man per day is charged at Rs. 1/-.
Do. 1 woman or boy Do. Re. 0—8—0

On an exhaustive survey of the crop, the following points are suggested for investigation:

Cultural:

(a) Whether it is necessary to leave a portion of the crop in the field itself a month or two more after the harvest of the main crop for purposes of seed.

(b) Whether there is any difference in yield or quality of turmeric grown from these 2 kinds of seed material viz., rounds and fingers.

(c) Investigations into the proper method of preserving round seed rhizomes so that the cheaper stuff can be used as seed material.

(d) The optimum spacing between the seed material sown in the field to get the maximum yield.

(e) The relative bad effects of growing various crops as a mixture with turmeric and finding out the most suitable crop that could be grown with the least harmful effects.

(f) How for the method of sowing could be done with minimum expenses and whether dibbling behind the plough as is done in Guntur could not be followed profitably in Coimbatore District also.

(g) The quality of water that is suitable and the frequency of irrigation at different stages of the crop and the optimum quantity of water necessary to give the maximum yield may be investigated.

(h) The possibility of economising on harvest charges by using bullock power for digging out the produce instead of doing it by manual labour.

Varietal :

To examine the possibility of producing a stuff suitable to the foreign market by proper selection from the produce collected from various places.

Manurial :

1. Relative value of different green manure crops that could be usefully advocated for turmeric, to increase yields.

2. Suggestion of a suitable rotation so that the fertility of the soil may be maintained.

3. Giving better facilities for ryots to get silt and compost from Municipality for their turmeric crop so that better yields could be obtained at a lesser cost.

4. Since manuring is likely to influence quality it will be interesting to find out suitable manures to improve the quality of crop.

General :

1. The Co-operative Sales Societies should be made more easily accessible to the ryots to sell the produce, by relaxing the formalities in the issue of crop advance loans.

2. These Co-operative Sales Societies establish contact with foreign merchants, to cut down the number of middlemen.

3. Many ryots have not got adequate facilities for preserving cured turmeric and as such have to hurriedly sell the produce to avoid loss through insect pests. Provision of proper storage facilities should be seriously considered in the Society godowns.

4. Every village Co-operative Society should have a power-driven turmeric polisher and the entire produce of the village should be polished in a common place.

5. The possibilities of other methods of curing the stuff, like deyhdration also need investigation.

THE THIRTY-SECOND COLLEGE DAY AND CONFERENCE

The thirty-second College Day and Conference organised by the Madras Agricultural Students' Union was held this year from 30th July to 2nd August 1949 under the distinguished presidency of the Hon'ble Sri P. S. Kumaraswami Raja, M.L.A., Premier, Government of Madras. The Hon'ble Minister for Agriculture Sri A. B. Shetty, M.L.A. was also kind enough to be present and open the Agricultural Exhibition arranged in connection with the College Day and Conference. Sri R. M. Sundaram, M.A., I.C.S., Director of Agriculture, Madras, the regional Deputy Directors of Agriculture, and nearly all the District Agricultural Officers of the Department were present and participated in the Conference proceedings.

The Conference commenced at 10–30 A.M. on Saturday the 30th July 1949 with a welcome speech by the Principal Sri M. C. Cherian. The Secretary of the Union then moved the following resolution "The Madras Agricultural Students" Union Coimbatore places on record its profound and deep sense of sorrow at the tragic end of Sri V. C. Vellingiri Gounder-keen Agriculturist in Coimbatore District and an old patron of the Union. The resolution was passed, all those present standing in silence for two minutes.

The Secretary, Sri K. Meenakshisundaram, then read out the messages received by the Union, from many of its well-wishers, followed by the reading of the Annual Report of the Managing Committee for the year 1948-49. Prizes were then distributed by the President, to the various prize-winners of the Agricultural College during the academic year ending June 1948.

The President then delivered his address, where he made an eloquent appeal to all to bend their energies towards solving the present food crisis. The Hon'ble Minister for Agriculture followed this speech by the Premier, by another thought-provoking address before declaring open the Agricultural Exhibition at 12 noon.

The Second Session commenced at 2 P. M. with Sri T. S. Avinashilingam Chettiar, M.A., M.L. M.L.A. in the chair in the unavoidable absence of the Premier and the Director of Agriculture Sri. R. M. Sundaram, opened the discussion and a number of very interesting papers were then read as part of a Symposium on "Transmission of Research-How best to translate the results of Research into General practice". After eight papers had been read, the subject was thrown open for discussion and the view points of the general public were expressed by Sri V. C. Palaniswami Gounder, Sri V. C. Subbiah Gounder, Sri P. S. Balarama Raju and Sri C. L. Soundararajan. Sri Avinashilingam Chettiar then wound up the first day's proceedings with a short but eloquent speech.

On the night of 30th July, the Union arranged for a Variety Entertainment. On Monday the 1st August the Conference was resumed at 8 A.M. and a number of papers were read. Owing to the large number of papers that had to be presented within a limited time, all speakers were requested to give a condensed talk on salient points without reading their papers in full. This had the effect of not only saving time but also of keeping the disscussion to the essential points. The public session of the Conference came to an end at 12 noon on Monday the 1st August, with the President's concluding remarks; the subsequent two sittings - one between 2-4 P.M. on Monday the 1st August and another between 10 A.M. to 1 P.M. on the 2nd August, being in the nature of a Departmental Officers' Conference, for discussion of specific issues and difficulties encountered in the implementation of the Grow-More-Food Campaign in daily practice. On the evening of the 2nd, the Union conducted the Annual College Sports and Tea. The Championship Cup for the best athelete was secured by Sri V. N. Lakshmanan of class II. The Hon'ble Minister for Agriculture, A. B. Shetty was present during all the sessions and evinced keen interest in the proceedings of the Conference.

Principal's Welcome Speech.

The Hon'ble Premier, the Hon'ble Minister for Agriculture, Director of Agriculture.

Ladies and Gentlemen,

As Principal and President of the Madras Agricultural Students' Union it is my proud privilege to extend to you all a cordial welcome to this - the thirty-second College Day and Conference. Our grateful thanks are due to the Hon'ble Premier - Sri Kumaraswami Raja - for graciously accepting our invitation to preside over this function. The very fact that he found time to come to us amidst his many pressing engagements, shows how deeply interested he is in matters pertaining to the welfare of the ryot. We are also thankful to Sri. A. B. Shetty, our Minister for Agriculture for consenting to declare the Exhibition open. As an agriculturist himself, he can speak with authority on matters agricultural and there is no doubt. that with him at the helm of affairs the destiny of the Department is in safe hands. We also express our thanks to Sri. R. M. Sundaram, Director of Agriculture, for his great interest in the affairs of the Union. Prior to his appointment as Director he has been connected with the Agricultural Department as Additional Secretary and therefore has a good knowledge of the problems confronting us.

The food problem is the most important problem of the day. The Prime Minister of India in his message to the Nation has appealed for co-operation in the drive for food production which is "ultimately a war

against poverty and ignorance, against malnutrition and high prices". The Director of Agriculture has at the recent press interview at Madras indicated the several measures which are being taken up for increasing food production. We can assure the Premier and the Minister for Agriculture that the officers of the Department will do their best to tackle the food problem.

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The results of the B. Sc. (Ag) Degree Examinations have been very satisfactory. Out of the 106 candidates including reference students who appeared for the Final Examination 104 have come out successful. I take this opportunity to congratulate them and particularly Sri A. Appa Rao, for winning three medals - Robertson medal for proficiency in Agriculture, Kees medal in Agricultural Chemistry and Raghunatha Rao Medal for the highest number of marks in practical agriculture in all the terminal and final Examinations.

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3. Before the weighment is made the round ones that may be found mixed with finger rhizomes are all picked out on a contract rate of a few annas per bag of 140 lbs. and the stuff is weighed. If any stones are found mixed with turmeric the weight of stones found in one maund is deducted at a flat rate from the entire weight of produce.

4. About 40 to 50 lbs. of turmeric for every 2,800 lbs. of produce will be given free towards the *Kalas* charges though the Commission agent also gets a portion of the same.

5. While the bags are being taken into the mundy or loaded in the cart the fingers dropped here and there will all be collected and stored by coolies specially employed by the Commission Agent and over which the ryots do not have any claim.

6. When the total value is worked out in addition to the usual commission at 0–1–0 per rupee, other deductions like "mahimai" "Dharmam" etc., are also made at a few annas per 280 lbs. of turmeric sold.

In the case of the Sales Society, in addition to the Commission they charge 0–2–0 per "sattai" or 280 lbs. towards kalas charges. There are no other deductions made. The round ones are purchased by the Commission Agents alone, always at a price Rs. 30/- per "sattai" less than that of finger rhizomes. Fingers which are uniformly thick, smooth, long and cylindrical, and which when broken, break with a sound and show a dark yellow colour are considered best and fetch the maximum price.

Preparing for Export: The produce purchased by the wholesale merchant at Erode is further prepared for the market. Nearly 75,000 bags of turmeric are being purchased at Erode by the merchants out of which 60,000 bags are from Erode, Bhavani and Gobichettiplayam taluks. About 12,000 bags are being received from Karur and 3,000 bags from other districts. The quality of the produce is different from place to place and one can easily identify the produce from a particular locality. For instance, the produce from Gobichettipalayam taluk will be long round, branched, smooth and breaks with a metallic sound. The Karur stuff is dull in colour. short, bent and always fetches Rs. 30/- per "pothy" of 280 lbs. The turmeric fingers from Salem are, thick, slightly shrunken and long. Alwaye turmeric is short, straight, sharp at both ends and is said to be superior for the manufacture of dye. But all these qualities are not always constant. Depending upon the demand from particular markets the produce from particular localities are sold at a high rate. For instance though Salem produce is purchased at a relatively cheaper rate at Erode it is sold in some years at Karachi for highest prices. Though the rounds are always purchased Rs. 30/- less per "pothy" than fingers, yet there have been years when the former has been, sold for foreign countries at a higher price than the latter.

So also different markets require different kinds of treatments of the stuff purchased by the merchants at Erode. For instance the produce sold at Karachi and Bombay has to be dry-polished for a second time in a power-driven polisher before it is exported and packed in gunnies of 96 lb. nett. When selling the produce through Calcutta the produce is given a colouring. Two Madras measures of turmeric powder got by powdering round rhizomes is mixed in 20 gallons of water and the coloured solution is sprinkled over turmeric taken in a basket and shaken constantly when the entire produce gets completely coloured. They are dried under shade and packed in gunnies of 164 lb. nett. By the former method there is a decrease in weight of 7 lb. for every 280 lb. and by the latter method there is an increase in weight by about 14 lb. per 280 lb. For turmeric sent to other places within India no other treatment is given. Though there are merchants at Erode who have ample facilities for trading with merchants in foreign countries they are only selling the produce through commission mundies at Karachi, Bombay, Calcutta etc., paying Rs. 2/- to Rs. 2—8—0 per Rs. 100/- because they are not able to supply to the foreign merchants at a specified time large consignments of quality for the following reasons:

1. The produce of different ryots varies in quality and produce of the same quality is not received all at one time.

2. The ryots do not sell their produce to the same merchant every year.

3. The quality of different localities varies considerably.

4. Facilities are not available for keeping the produce for a longer time in the godowns without being attacked by insects.

The ryots who are not able to sell their produce in the same year generally preserve the produce underground.

Pests and Diseases: The damage caused by insects to turmeric is negligible, but the leaf-spot disease which in some cases does great havoc is very important and worth mentioning, According to ryot is the disease is severe in years of drought. The ryots have realised that use of healthy seed material always produces encouraging results.

Land Tenure System: In Coimbatore District, when turmeric is cultivated in garden lands on lease system, the tenants have to pay at 5—6 pothies (280 lb. for pothy) of turmeric per acre per year or Rs. 300/- per acre. In wetlands in Erode taluk 6 to 8 pothies (192 Madras measures per pothy) of paddy per acre per year is common. The yield of the crop is about 18 sattais or 3,240 lb. per acre in Gobi, 4,000 lb. in portion of Bhavani and 2,7000 lb. in Erode and other places.

Cost of cultivation for one acre of turmeric in Coimbatore District:

	M.D.	W.D.	C.D.	B.D.	Rs.	A.	P.
***Preparatory Cultivation*:**							
Ploughing 6 times	8		4	8	24	0	0
***Manures and Manuring*:**							
Carting Farmyard manure and Silt from the yard. ...	6			4	14	0	0
Spreading manure. ...	4				4	0	0
Covering manure. ...	1½			1½	4	0	0
Cost of 50 cartloads of farmyard manure at Rs. 4 per cartload. ...					200	0	0
Cost of 100 cartloads of silt at 0—8—0 a cartload. ...					50	0	0
***Seeds and Sowing*:**							
Forming ridges and furrows with country plough and reforming with mammoties. ...	5		1¾	1	7	0	0
Cost of 20 Sadus of seed rhizomes at Rs. 15/- per Sadu					300	0	0
Sowing and reforming ridges	8	4			10	0	0
Dibbling onions—8 bags at Rs. 6/- per bag. ...		16			56	0	0
***Irrigation*:**							
40 irrigations at Rs. 12/- per irrigation. ...					480	0	0
***After Cultivation*:**							
Weeding by means of hand hoe. ...	20				10	0	0
Mammoty weeding and earthing up. ...	24				24	0	0
Harvesting onions. ...		40			20	0	0
Cutting turmeric stalks. ...		4			2	0	0
Harvesting rhizomes. ...	20	60			50	0	0
Curing turmeric. ...	8	3			9	8	0
Watch for 10 days. L. S.	10				5	0	0
Hire on boiling pan at 0—8—0 for three days. ...					1	8	0
Polishing. ...	10				10	0	0
Hire charges at Re. 1/- for 2 days. ...					2	0	0

Marketing:	M. D.	W. D.	C. D.	B. D.	Rs.	A.	P.
Transporting to market at 0—8—0 per bag for 40 bags.					20	0	0
Kalas at 0—2—0 per bag.					5	0	0
Lease 5 pothies of turmeric at Rs. 140 per pothy. ...					700	0	0
Fuel ...					40	0	0
					2,048	0	0

Receipts:

	Rs.	A.	P.
Cost of 20 sattais of turmeric at Rs. 140/- per pothy. ...	2,800	0	0
Cost of 20 bags of onions at Rs. 6/- per bag.	120	0	0
	2,920	0	0
Net profit per acre.	872	0	0

The hire for 1 pair of bullocks is charged at Rs. 3 per day.

The hire for 1 man per day is charged at Rs. 1/-.
Do. 1 woman or boy Do. Re. 0—8—0

On an exhaustive survey of the crop, the following points are suggested for investigation:

Cultural:

(a) Whether it is necessary to leave a portion of the crop in the field itself a month or two more after the harvest of the main crop for purposes of seed.

(b) Whether there is any difference in yield or quality of turmeric grown from these 2 kinds of seed material viz., rounds and fingers.

(c) Investigations into the proper method of preserving round seed rhizomes so that the cheaper stuff can be used as seed material.

(d) The optimum spacing between the seed material sown in the field to get the maximum yield.

(e) The relative bad effects of growing various crops as a mixture with turmeric and finding out the most suitable crop that could be grown with the least harmful effects.

(f) How for the method of sowing could be done with minimum expenses and whether dibbling behind the plough as is done in Guntur could not be followed profitably in Coimbatore District also.

(g) The quality of water that is suitable and the frequency of irrigation at different stages of the crop and the optimum quantity of water necessary to give the maximum yield may be investigated.

(h) The possibility of economising on harvest charges by using bullock power for digging out the produce instead of doing it by manual labour.

Varietal:

To examine the possibility of producing a stuff suitable to the foreign market by proper selection from the produce collected from various places.

Manurial:

1. Relative value of different green manure crops that could be usefully advocated for turmeric, to increase yields.

2. Suggestion of a suitable rotation so that the fertility of the soil may be maintained.

3. Giving better facilities for ryots to get silt and compost from Municipality for their turmeric crop so that better yields could be obtained at a lesser cost.

4. Since manuring is likely to influence quality it will be interesting to find out suitable manures to improve the quality of crop.

General:

1. The Co-operative Sales Societies should be made more easily accessible to the ryots to sell the produce, by relaxing the formalities in the issue of crop advance loans.

2. These Co-operative Sales Societies establish contact with foreign merchants, to cut down the number of middlemen.

3. Many ryots have not got adequate facilities for preserving cured turmeric and as such have to hurriedly sell the produce to avoid loss through insect pests. Provision of proper storage facilities should be seriously considered in the Society godowns.

4. Every village Co-operative Society should have a power-driven turmeric polisher and the entire produce of the village should be polished in a common place.

5. The possibilities of other methods of curing the stuff, like deyhdration also need investigation.

THE THIRTY-SECOND COLLEGE DAY AND CONFERENCE

*

The thirty-second College Day and Conference organised by the Madras Agricultural Students' Union was held this year from 30th July to 2nd August 1949 under the distinguished presidency of the Hon'ble Sri P. S. Kumaraswami Raja, M.L.A., Premier, Government of Madras. The Hon'ble Minister for Agriculture Sri A. B. Shetty, M.L.A. was also kind enough to be present and open the Agricultural Exhibition arranged in connection with the College Day and Conference. Sri R. M. Sundaram, M.A., I.C.S., Director of Agriculture, Madras, the regional Deputy Directors of Agriculture, and nearly all the District Agricultural Officers of the Department were present and participated in the Conference proceedings.

The Conference commenced at 10-30 A.M. on Saturday the 30th July 1949 with a welcome speech by the Principal Sri M. C. Cherian. The Secretary of the Union then moved the following resolution "The Madras Agricultural Students" Union Coimbatore places on record its profound and deep sense of sorrow at the tragic end of Sri V. C. Vellingiri Gounder-keen Agriculturist in Coimbatore District and an old patron of the Union. The resolution was passed, all those present standing in silence for two minutes.

The Secretary, Sri K. Meenakshisundaram, then read out the messages received by the Union, from many of its well-wishers, followed by the reading of the Annual Report of the Managing Committee for the year 1948-49. Prizes were then distributed by the President, to the various prize-winners of the Agricultural College during the academic year ending June 1948.

The President then delivered his address, where he made an eloquent appeal to all to bend their energies towards solving the present food crisis. The Hon'ble Minister for Agriculture followed this speech by the Premier, by another thought-provoking address before declaring open the Agricultural Exhibition at 12 noon.

The Second Session commenced at 2 P. M. with Sri T. S. Avinashilingam Chettiar, M.A., M.L. M.L.A. in the chair in the unavoidable absence of the Premier and the Director of Agriculture Sri. R. M. Sundaram, opened the discussion and a number of very interesting papers were then read as part of a Symposium on "Transmission of Research-How best to translate the results of Research into General practice". After eight papers had been read, the subject was thrown open for discussion and the view points of the general public were expressed by Sri V. C. Palaniswami Gounder, Sri V. C. Subbiah Gounder, Sri P. S. Balarama Raju and Sri C. L. Soundararajan. Sri Avinashilingam Chettiar then wound up the first day's proceedings with a short but eloquent speech.

On the night of 30th July, the Union arranged for a Variety Entertainment. On Monday the 1st August the Conference was resumed at 8 A.M. and a number of papers were read. Owing to the large number of papers that had to be presented within a limited time, all speakers were requested to give a condensed talk on salient points without reading their papers in full. This had the effect of not only saving time but also of keeping the disscussion to the essential points. The public session of the Conference came to an end at 12 noon on Monday the 1st August, with the President's concluding remarks; the subsequent two sittings – one between 2-4 P.M. on Monday the 1st August and another between 10 A.M. to 1 P.M. on the 2nd August, being in the nature of a Departmental Officers' Conference, for discussion of specific issues and difficulties encountered in the implementation of the Grow-More-Food Campaign in daily practice. On the evening of the 2nd, the Union conducted the Annual College Sports and Tea. The Championship Cup for the best athelete was secured by Sri V. N. Lakshmanan of class II. The Hon'ble Minister for Agriculture, A. B. Shetty was present during all the sessions and evinced keen interest in the proceedings of the Conference.

Principal's Welcome Speech.

The Hon'ble Premier, the Hon'ble Minister for Agriculture, Director of Agriculture.

Ladies and Gentlemen,

As Principal and President of the Madras Agricultural Students' Union it is my proud privilege to extend to you all a cordial welcome to this – the thirty-second College Day and Conference. Our grateful thanks are due to the Hon'ble Premier – Sri Kumaraswami Raja – for graciously accepting our invitation to preside over this function. The very fact that he found time to come to us amidst his many pressing engagements, shows how deeply interested he is in matters pertaining to the welfare of the ryot. We are also thankful to Sri. A. B. Shetty, our Minister for Agriculture for consenting to declare the Exhibition open. As an agriculturist himself, he can speak with authority on matters agricultural and there is no doubt that with him at the helm of affairs the destiny of the Department is in safe hands. We also express our thanks to Sri. R. M. Sundaram, Director of Agriculture, for his great interest in the affairs of the Union. Prior to his appointment as Director he has been connected with the Agricultural Department as Additional Secretary and therefore has a good knowledge of the problems confronting us.

The food problem is the most important problem of the day. The Prime Minister of India in his message to the Nation has appealed for co-operation in the drive for food production which is "ultimately a war

against poverty and ignorance, against malnutrition and high prices". The Director of Agriculture has at the recent press interview at Madras indicated the several measures which are being taken up for increasing food production. We can assure the Premier and the Minister for Agriculture that the officers of the Department will do their best to tackle the food problem.

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The results of the B. Sc. (Ag) Degree Examinations have been very satisfactory. Out of the 106 candidates including reference students who appeared for the Final Examination 104 have come out successful. I take this opportunity to congratulate them and particularly Sri A. Appa Rao, for winning three medals - Robertson medal for proficiency in Agriculture, Kees medal in Agricultural Chemistry and Raghunatha Rao Medal for the highest number of marks in practical agriculture in all the terminal and final Examinations.

In this connection, I may be permitted to say a word about our Agricultural Graduates. The B. Sc. (Ag) is a three-year course where intensive training both in theoretical and practical agriculture and allied subjects is given. The University of Madras recognises this degree as

equivalent to B.Sc. Hons. or B. A. Hons. Hence it is but fair that the Government should consider the graduates of this College to be on a par with Hons. graduates for recruitment to services and not on a par with B.A. or B.Sc. as recently announced by Government.

I would also like to make another request and that is regarding the Madras Agricultural Journal. The publication of this, is a major activity of the Union. The Journal is an important link between the Agricultural Department and the Public, While thanking the Government for the small subsidy they have given us it may be mentioned that it is not possible with this amount to effect much improvement in the get-up of the Journal. Hence I request the Minister for Agriculture to consider favourably the grant for an enhanced subsidy.

Ladies and Gentlemen, I thank you once again for your presence here. Let us hope that as a result of our deliberations it will be possible to devise ways and means of helping to solve the food problem.

Report by the Secretary.

The Hon'ble Premier, the Hon'ble Minister for Agriculture, Director of Agriculture, Ladies and Gentlemen,

The Managing Committee of the Madras Agricultural Students' Union have great pleasure in presenting their report for the year 1948-49.

It is of good augury for the Union that it has been able to secure the presence of two members of the cabinet on this occasion and we take it as a recognition by Government of the importance of our annual conference in the development of progressive agriculture in our province. A number of distinguished men have graced this conference before, but it is for the first time, the Union has been fortunate in getting the Premier of the Province to preside over its annual deliberations. Moreover, apart from his interest in our affairs in his capacity as Premier Sri. Kumaraswami Raja has all along been a well-wisher of the Madras Agricultural Department. A keen and practical agriculturist himself, he has been in close touch with our activities long before he assumed the responsibilities of office and we believe he is one of those few public men who can speak with first-hand knowledge on matters pertaining to the agriculturist and his relation with the Department.

The Hon'ble Minister for Agriculture, Sri. Shetty, though perhaps, a comparative stranger to the activities of our Department, if we may say so, is a member of an important agricultural community and we take it that in spite of his sojourn in other spheres, he is at heart an agriculturist

and could therefore be expected to take more than a mere administrative interest, in the progress of scientific agriculture in this Province. The Union is extremely grateful to both of you Sirs, for the honour done to it by your presence here to-day.

It is a regrettable fact, that the food problem which has been with us, ever since the first years of World War II has not yet been solved and in spite of great efforts, we have succeeded only to a limited extent in augmenting our own production and we are still dependent on foreign imports to provide even the absolute basic minimum requirements of the nation. True, we have been able to avert actual famine and death by starvation and this by all means is no small achievement in itself in a large country like ours and when considered in the background of the world situation, to-day. But the fact has to be faced that a large mass of our population, not excluding the well-to-do class, is in a state of chronic under-nourishment and we can ill-afford to continue our dependence on other countries for the supply of the basic necessities of mere existence. Rightly therefore have our leaders stressed the need for directing all our thoughts, energy and resources towards solving this vital problem of food to the exclusion of everything else.

The nation has been asked to expect no further food imports from foreign countries after the year 1951 and the Prime Minister of India has appealed to the nation to concentrate its attention on this problem. We, the members of the Department, are fully aware of the very great responsibility we have to shoulder in the coming years in order to fulfil the expectation of our leaders and to implement the policies and programmes set down by Government. May we take this opportunity, to assure you Sir, and through you the people of this Province, that we would do our utmost not merely as men paid to do their job but as willing and zealous workers in the great national cause and be proud of the part we are asked to play in this great task.

It is a welcome sign of the times, that the agriculturist, long neglected and taken for granted is at long last being recognised as the most important factor in our national economy and is becoming the centre of attention on the part of the Government and the people. The various legislative enactments of recent times we note with pleasure, have been sponsored with a view to improving the lot of the tiller of the soil and helping him to attain a higher standard of life and raising him to a plane where his voice would be heard with respect and his influence felt. We have no doubt, that the test of this nation's progress lies in how far it has succeeded in bettering the conditions of the agriculturist in the village, for on him depends, more than any other, the future welfare of this Country.

We will not, Sirs, burden you with a catalogue of our grievances as is customary on occasions like these. But we would refer to one or two matters pertaining to the working of the Department which merit your attention. The members of the Union feel that it should be no longer necessary, that the technical staff should be burdened with work relating to the various trading schemes, a work which was necessitated during the period of war. We are glad to note that the Government have accepted this principle and we would request, that as early as exigencies of administration would permit that the responsibility of operating the trading schemes should be transferred entirely from the Taluk Demonstrator.

Another matter in which the Union is interested in, is the welfare of the graduates of the two Agricultural Colleges of the Province. We regret to note, that at a time like the present, when the services of these men should be utilised to the fullest extent in the interest of the Province, a large number of them are not employed or employed in avocations where their special training could not be made use of. Their absorption in the Revenue and other Departments would help a little, but we have to stress, that the best way to utilise them is in the Agricultural Department itself and as long as candidates are available from among the *alumini* of the two colleges, for filling up vacancies in the various branches of the Department, they should be given preference over others, as a rule.

May we, in this connection, point out that the degree course in Agriculture in this Province is taken three years after passing the Intermediate examination in Arts and the syllabus prescribed covers a wide range of subjects like Chemistry, Zoology, Botany, Engineering, Agricultural Economics and Animal Husbandry in addition to Agriculture. The hours devoted to the study of the science subjects are not less than in the B.A. or B. Sc. degree pass course and we may add, Sir, that the practical training imparted in the two agricultural institutions in our Province is more intensive and strenuous than in the Arts Colleges. For these reasons, our graduates claim that their degrees should be considered on a par with the Honours degree of the University for purposes of recruitment to public Services.

At present, the competitive examinations held by the Federal Public Service Commission for recruitment to the All India General Administrative and Audit Services are not open to the Agricultural Graduates and we crave your indulgence and make a respectful request that a representation may be made to the Central Government on this matter.

The Madras Agricultural Students' Union : The Union was founded in the year 1911 and was originally intended as an organisation to bring together in a common bond of interest the past students of Saidapet

Institution and the past and present students of the Coimbatore Agricultural College and to this list has now been added, the old and new students of the Bapatla Agricultural College. It has, through the last three decades, been able to widen its scope of usefulness and stands to-day in its 38th year of its existence claiming as an organisation which serves not merely as an Old Boys' Association but as a link between the Department and the public.

Finance: Owing to the enforced interruption of its activities during the period of war, the financial position of the Union, none too secure even in pre-war years, considerably worsened and the high cost of printing and paper would have made it impossible for the Committee to run the journal during the year, but for the timely aid of the Government with a grant of Rs. 1,800/-, which partly meets our heavy expenditure. The Union takes this opportunity to place on record its sense of gratitude to the Government and the Director of Agriculture for this great help rendered to the organisation. In this connection, we have also great pleasure in recording the appreciation of the Committee for the readiness with which the students of both the agricultural colleges consented to have their subscription enhanced, at its request.

The stability of an organisation depends on its financial security and to the extent we prove ourselves worthy of Government support the Committee is sure that the Government will help us. For this we need the active co-operation of all the members of the Department to the fullest possible extent and we appeal to such of those who have not yet enrolled themselves as members and those who have discontinued their membership during the past few years, to join the Union forthwith and strengthen the organisation.

Conference: The celebration of the Annual College Day and the Organisation of an Agricultural Conference is one of the main activities of the Union. The Thirty-First Annual College Day and Conference was celebrated last year from 27th July to 1st August. The Hon'ble Sri K. Madhava Menon, then Minister for Agriculture, presided over the Conference. A symposium on "The Present Food Crisis and its Solution" was organised for the Conference, in which many prominent workers in the field, official and non-official participated. Besides the usual items such as sports, entertainments, etc., an agricultural exhibition demonstrating the various activities of the Department was also organised for the benefit of the visitors and the public. A detailed account of the proceedings of the celebrations has already appeared in the August number of the Madras Agricultural Journal.

May we, in this connection, respectfully submit that the purpose of this Conference would be better served, if a number of subordinates along with a few representatives of the Bapatla College also are deputed to attend it. It is essential that periodical opportunities should be afforded to

the mofussil workers to contact the parent institution and we hope that the slight extra expenditure involved would not stand in the way of Government granting our request. In making this request, we may be permitted to point out that on previous occasions the deputation of quite a large number of subordinates was a regular feature and we will be reverting only to an established practice which was interrupted during the war years.

The Madras Agricultural Journal: Besides celebrating the Annual College Day and conducting the Agricultural Conference the-all-the-year activity of the Union is the publication of the Madras Agricultural Journal. We are glad to record that the Journal continued to maintain the high standard associated with it. We are proud to note that research workers in departments and institutions outside our Presidency, have come to feel, that our Journal has a place among the scientific journals of the world and are seeking its aid for the publication of the results of their research activities. It has on its exchange list a wide range of publication from many places both India and foreign. The present get-up of the journal allows considerable scope for improvement and we therefore request that the Government may be pleased to enhance the present subsidy to at least Rs. 4,000/- to make the Journal more attractive

Our New Patrons: We are glad that Sri P. Karuthiruman, B. Sc. of Nanjaipuliampatti, and K. Venkataswami Naidu, B. A., B. L. of Coimbatore have become patrons of our Union during the year.

Obituary: We recorded with deep regret the premature and tragic demise of Sri V. C. Vellingiri Gounder, M. L. C., Coimbatore, an old patron and well-wisher of our Union. He never missed a conference and was taking an active part in our deliberations. We feel his absence this year. We take this opportunity to convey our condolence to the bereaved family.

Acknowledgment: It is now our pleasant duty to record our thanks to all those who have helped the Union during the year. To the Hon'ble Sri. K. Madhava Menon, the Union owes a debt of gratitude for presiding over the last year's conference and to Mrs. Kuttimalu Amma, our thanks are due for distributing the prizes and declaring the Agricultural Exhibition open. To Sri. M. C. Cherian, who as ex-officio President has identified himself with the Union and Sri. P. V. Ramiah, who have given us his help and co-operation in our contact with the Bapatla Agricultural College, the Managing Committee offers its heartfelt thanks for guiding the the affairs of the Union during the year. To Sri. M. S. Sivaraman, I. C. S., former Director of Agriculture and to Sri. R. M. Sundaram, I. C. S., O. B. E., the present Director of Agriculture, the Committee tenders its grateful thanks for their sympathy and help rendered to the Union. To all those ladies and gentlemen who helped to make the last Conference a success and helped the Committee during the year in many ways, our thanks are herein recorded.

The Hon'ble Premier's Presidential Address

Gentlemen and friends,

I deem it a unique pleasure and privilege to be called upon to preside over this function, celebrating the 32nd College Day and Conference, under the auspices of the Madras Agricultural Students' Union. My association with this function, might be deemed significant, in more than one respect. That I was Minister for Agriculture three years ago, having had concern over the Department of Agriculture and that I now happen to be the Premier of the Province, would be taken as factors bearing significance in my association with today's function. But to me, however, those factors do not appear to be of significance in relation to today's function; because, anything done in the capacity as Minister or Premier, goes as the discharge of one's own duty; and therefore, those circumstances would not bear any special significance so far as my association with today's function is concerned. But what fiills me with immeasurable pride and pleasure and what appears to me as of special significance, is the fact that an ordinary ryot and agriculturist, that I am, should be called upon to preside over this function, celebrated by the premier Agricultural Institution of this Province. So, I take the invitation to me for this function, not only as an honour done to me personally as an agriculturist, but also an honour done to millions of agriculturists in our land. In 1926, I had the pleasure of attending the annual festival of yours; I recollect the days that I spent here happily, visiting the several farms here and attending several functions in the programme of celebration of the Annual Day and Conference. Little did I expect then that 23 years afterwards I would get the honour of occupying the presidential seat in the annual day celebrations.

I view this annual day and conference as a festival for agriculturists. The fate of the agriculturist depends upon the fate of the agriculture-industry, for the progress and development of which this institution lives and works for. Agriculture has been from the very early times the mainstay for our people in this country. Even today, it remains as the backbone of our country's prosperity. The wave of industrialisation, accelerated by modern science and scientific inventions, which has passed through certain leading countries of the world and put them in the vanguard of industrial progress, has not had much effect so far as India is concerned. In those advanced countries, the natural wealth available to them by means of agriculture, has been supplemented, to a very great extent, by fresh acquisitions of wealth, earned through other industries; and thus they are rendered not only self-sufficient but also placed in a position of abundance and prosperity. In the industrially advanced countries, even the agriculture-industry has been modernised and brought up to date by adoption of the modern scientific contrivances for the improvement of

agriculture. We have seen how a country like Japan, which had no record to boast of, about half a century ago in its agricultural industry, came to occupy the forefront in agricultural-wealth, as a result of her adopting modern and scientific methods of agriculture with tremendous effort and sustained application. Maintaining agriculture, as a successful and prosperous industry and the large-scale production of agricultural produce, were targets aimed at by those countries, in their schemes for national regeneration and economic prosperity. Those advanced countries, independent as they are, have worked their schemes on a well-planned basis, with patriotic zeal and desire, to provide food for their people, by improving their country's natural wealth, and putting them in prosperity.

But in India, the tale is different. Here the factors responsible in keeping agriculture as a plant of stunted growth are many. The indifference of the ryots to take up to modern and scientific ways of cultivation, their poor investing capacity, the vagaries and vicissitudes of the seasons, and other kindred factors, have been the main obstacles against planned cultivation and agricultural development. These factors, deplorable as they are, ought to have stirred the Government into action ; and any Government functioning for the good of the people, could not afford to be indifferent to the need for taking steps for the early liquidation of such obstacles or handicaps in the improvement of our country's natural wealth. But, having been subject to foreign rule, how could we expect the foreign bureaucratic Government to throw themselves heart and soul in schemes of development of industries including Agriculture for the benefit of our people ? What little they did, for the improvement of agriculture in our country, was done by them more to meet the needs of export of produce essential to their own country than to look to our benefit. The attention of the foreign rulers was bestowed more on the improvement of the commercial crops which were to feed the factories in their own country. To bring more land under the plough, for increasing the production of foodgrains like paddy and millets etc., did not form the foremost among the items in the scheme of agricultural devolopment carried out by them. Commercial crops like cotton, tobacco, etc., have engaged their attention more than foodgrains ; because feeding their own mills and factories in Britain, was more important to them, than feeding our people.

Under the foreign rule, our country's rural economy was on the wane, and the general standard of living among the villagers who were mostly ryots and agriculturists, was on the decline. Want of self-sufficiency has become the normal feature in the food position in our country. So much so, seasonal failures could not be stemmed over easily, unless by the import of foodgrains from other countries. Up to the outbreak of recent world-war, our people were not really conscious of the

deplorable condition in the food production in our country, as the insufficiency was made up by imports of foodgrains from other countries. But the outbreak of the war, has made us fully conscious of the precariousness of our position in the matter of food production. The seriousness of the food situation has been accentuated tremendously, during the war years and even after, which we are experiencing very bitterly even today. The countries, on which we have been depending for the imports of foodgrains, have been cut off from us, the inevitable consequences of the world-war. The war, causing disturbance in the agricultural industry in those countries and causing also tremendous dislocation in international trade, and thus depriving us of our usual sources of import of food grains, has rendered our country's food problem, more deplorable. We were hoping that the cessation of the world-war would bring relief to us; but the events have proved otherwise. The termination of the war, has only made our food position, more acute.

The increase in population, with no corresponding increase in food supply, is another factor, that has rendered the food problem more serious. Furthermore, the partition of our country, with the consequent loss of large food-producing tracts, of Sind and the Punjab, has also brought strain to the already strained food-problem. And this is the heritage that we had to take up on our assumption of independence. An independent nation, as we are today, we can not afford to be indifferent, to the food-problem which is acute. The attainment of freedom has tremendously enhanced our responsibility to find out an escape from it. We could not afford to be blind or insensitive, to the vital need of the day; everyone of us, who has at heart, the well-being and the economic prosperity of our people, should seriously think of getting over the situation facing us. We should proceed on a planned scheme of cultivation, for production of more food, by setting before us a time-limit, within which we should endeavour to reach the target of self-sufficiency and make ourselves independent in food production. In this endeavour the Governments alone cannot find solution of the problem, in the absence of the willing co-operation of the people themselves. It is the declared policy of the Central Government that the food imports from outside countries should be stopped after 1951. To hit the target of self-sufficiency in food within the said time limit, the Provinces have been asked to step up food production. Several schemes, aiming at production of more food, have been sponsored by our Provincial Government.

The well-subsidy scheme is already at work. Under the subsidising system, a large number of wells have been brought into existence in dry tracts and districts, which are not favoured with any river and canal irrigation systems. The uncertainty of the seasonal conditions leave the ryots in those areas to the tender mercy of fate. In those areas, wells

form a very valuable supplement as a source for irrigation. That the well-subsidy scheme is a very benevolent measure from the point of view of the ryots, there can be no doubt. But the success of any scheme, however well-meant or benevolent it be, depends also on the co-operation of the ryots, for whose benefit it is intended. It is deplorable and even painful to hear of some instances of abuse made under the well-subsidy scheme. It is brought to our notice that in certain cases with the subsidies got from the Government, wells were not dug at all and that they were shown only on paper. Such complaints, if true, would only speak of the dishonesty and treachery, on the part of those, who are parties to the perpetration of such fraud on the State funds, and who for that reason should be treated as the enemies of the nation. They do great disservice to the country at a time when every individual should strain his nerve to put forth all his effort to tide over the national emergency, namely the semi-starvation of our people by reason of food insufficiency. In curbing such misdoings and dishonest methods, the responsibility lies on both officials and non-officials. The latter particularly should take a leading part in bringing the wrong-doers to book, as they should realise that their cause would suffer by the misdeeds of a few persons.

The grant of subsidies to the wells is not the only benevolent scheme sponsored by the Madras Government. The passing of an enactment recently by the Madras Legislature for the improvement of tanks, water-courses and other sources of irrigation, is also another step, towards the improvement of food production. The object of this legislation is to ensure the availability of more water for irrigation. You are also aware of the Agricultural Bill proposed by the Madras Government, which has been recently published in the papers for the purpose of eliciting public opinion thereon. The main object underlying the bill is to create an urge in the actual cultivator of the soil for intensive cultivation and for increased output of foodgrains and other agricultural produce, and also for bringing under the plough vast tracts of land that still remain fallow. Of course, some of the provisions of the Bill may look objectionable, particularly from the point of view of absentee landlordism. But when you are engaged in tackling a problem of vital importance, namely the increase of food production for feeding the people and make our country self-sufficient in that respect, rights of individuals should yield in favour of the general good to the community as a whole. I request the public to help our endeavours by offering well-informed and constructive criticism of the Agricultural Bill, for our guidance and action. You may rest assured, that our Provincial Government, are not going to leave any stone unturned, in the matter of finding a solution to the food problem.

I appeal to you—those in the Department of Agriculture, and those who are undergoing courses of studies and training, in the Agricultural Colleges and who are to take up their places in the machinery of the

Agricultural Department—to realise the great responsibility hanging on us. The responsibility, though a collective one, is to be borne by every individual; and every individual has to play his part in implementing the schemes of the Government, aiming at the well-being and prosperity of the people. Whatever be the policies propounded by the Government, the agency charged with the function of executing those policies, are yourselves, namely those in service in the Department of Agriculture and those interested in Agriculture. Therefore, you should be actuated with patriotism and a high sense of duty. There must be conjoint work done in a spirit of co-ordination for the common good of the people.

The functions of the State are executed through the several departments of the Government, each of which makes its own quota of service for the community. But the function of the Agricultural Department is, I can say, the most vital of all; because it is concerned with the production of food and more food, for the people. Not only food production but also production of other agricultural products on which depends the development of many industries, are matters to be thought of, shaped and guided by you. No doubt, the Agricultural Department in the very nature of its functions may not admit of wielding power over the people as some other departments do. But is the wielding of power, the criterion to judge the usefulness of the department? Your function, being one concerned with the production of food and supply of life and energy of the people, would your department, engaged in such benevolent function, be considered any the less important, merely for the reason that there is no wielding of power associated with it?

I earnestly appeal to those of you in service and especially those who are in touch with the ryots and cultivators in the villages, to discharge your duties in a spirit of service to the community. Your task may look arduous at times. The people, with whom you have to move day in and day out, are mostly rural folk. While you are in their midst, you must make them feel that you are one among them, so that your advices may be received by them, in a homely spirit. By your patience, kindness and perseverence, you should try to convince the ryots, of the need for the adoption of modern methods of cultivation, the use of modern implements, the use of good seeds, the application of manure, and the rearing of crops and plants in general in scientific ways. You should move among the villagers with the heart and mind of a missionary, having a great mission to fulfil.

I should, however, like to give you a word of caution, cautioning you not to proceed on the assumption that the ryot knows nothing of agriculture. You should know that there are certain good aspects found in their own method of cultivation which they have gained as a result of their traditional experience, in the course of ages. If the young

demonstrator, in his enthusiasm to take credit for his learning at the college, begins to teach the villagers the first lessons in botany, he is more likely to earn contempt than credit from the villagers; because the ryots, though unaccustomed to certain modern methods and implements of agriculture, have, as pointed out already, some good aspects to their credit, resulting from their traditional experience in agriculture. Your function should be, how best to harmonise the results of your researches in the laboratories, with the traditional ways of cultivation practised by the ryots. If anything done by the ryots of a particular area or locality appeals to you as a good method in agriculture, you should not be slow to accept it. You should study it with a critical mind backed up by your scientific knowledge and learn for yourself the causes and aspects that contribute to the superiority of that particular method. And you should try to popularise that method in other places also. Assimilation of anything and everything that is found to be good, should be the guiding principle, in your evolving a practical and useful system, which will ensure good results.

As to how exactly you are to bring about the harmonious combination of your scientific knowledge gained at the colleges with the practical and traditional methods of cultivation carried on by the ryots, you are a better authority to say than myself; because you are trained experts. An occasion like this should offer a splendid opportunity for the members of the Agricultural Department and others interested in agriculture to meet in conference and discuss matters of common interest, particularly those relating to the problem of food production, which is the vital need of the hour. All of you shall pool your knowledge and experience and co-ordinate with each other towards the common end, and I hope that this conference shall prove an eventful one in that direction.

In your annual report you have drawn the Government's attention to certain matters, which, it is stated require rectificaion. With regard to your representation that it is no longer necessary that the technical staff should be burdened with work relating to various trading schemes, I am in agreement with you. The Government will see to the transfer of responsibility of operating the trading schemes from the Taluk Agricultural Demonstrators. With regard to the employment of the graduates of the Agricultural College in other departments of the Government, there is at present no bar existing against their recruitment to those departments, as the agricultural degree is recognised as a qualification for the selection of candidates for Government service.

You have also represented that at present the competetive examinations held by the Federal Public Service Commission for recruitment to the All-India General Administrative and Audit Services, are not open to Agricultural Graduates. I am not aware of the

extistence of any such bar imposed by the Federal Public Service Commission with regard to Agricultural Graduates. If it exists, I should think that it is really a hardship to the Agricultural Graduates. It is high time that steps taken are to see to the removal of such a bar; and you can count upon the assistance and support of the Madras Government in any move in that direction. With regard to the absorption of the Agricultural Graduates in the various branches of the Agricultural Department, there can be no doubt that the Agricultural Graduates should be given preference. That principle stands to reason and fairness. You have also referred to certain other matters in the report. I may say that I shall bestow my close attention on those matters and do whatever is possible.

In conclusion I thank you for your kindness to me.

The Hon'ble A. B. Shetty, M. L. A., Minister for Agriculture's Speech

Ladies and Friends,

We are meeting at a time when Agriculture and Food Supply has become the major problem of the day. The world is passing through a troubled period of its history. According to Aldous Huxley the human race is facing a double crisis to-day—a political and economic crisis at an upper level and another crisis in population and world resources at a lower level. The immediate causes of the upper level crisis are the economic breakdown due to the last world war and the struggle for power between the two groups of nations led by America on one side and Soviet Russia on on the other. The crisis in population and world resources intensifies the crisis on the political and economic levels and leads to greater rivalry between the two power blocs for the possession of the earth's resources. A recently published book called 'Road to Survival' has attracted a great deal of notice in thinking circles. It sounds a note of alarm regarding the serious depletion of the earth's resources and the resulting danger of it to the fast growing population of the world. Food-its production and distribution — has become a matter of international concern. The Food and Agricultural Organisation started by the United Nations Organisation is engaged in finding out ways and means of developing agricultural and food resources to meet the needs of a fast-growing population.

In our country the solution of food problem has become the pre-occupation of our time. It is a thousand pities that a predominently agricultural country like ours should be faced with food shortage and that it should be put to the necessity of importing food from foreign countries at a heavy cost to the National Treasury. The growth of population at the rate of about 4 millions a year makes the question of food supply a permanent problem in this country. The partition of the country has made us lose the wheat and rice surpluses of Western Punjab and Sind.

Some of the best irrigated tracts have gone under Pakistan and made us more dependant on the vagaries of the monsoon. The civil war in the rice-exporting countries of Asia resulting in a decline in food production, shortage of fertilisers and manures like groundnut cake, inadequate supplies of essential materials like iron and steel for agricultural implements and cart tyres and a succession of bad seasons are among the factors that have added to our difficulties in regard to the food situation. The Grow More Food campaign started in 1942 under the Adviser Regime has not produced the results expected from it. In 1947 the present popular Government followed it up with a five-year plan of food production and this too has not yet brought us relief. Our food production is very much in the nature of a gamble in the monsoon. The first requisite for increasing food production is an assured supply of water. All possible irrigation sources have, therefore, to be developed to provide more water for agricultural purposes. Madras has several long-term and short-term plans of irrigation development. Since the major irrigation projects that have been taken up require a number of years for completion, Government have launched upon a five-year programme of minor irrigation works which are expected to be completed by 1952 at an estimated cost of 6 to 7 crores. Besides such new irrigation schemes, steps are being taken to restore the lost capacity of the existing irrigation tanks which are about 25,000 in number in ryotwari areas, and this will cost several crores of rupees. Since the inception of the G. M. F. campain, a sum of Rs. 5.78 crores has been given as subsidy for digging new wells and repairing old wells until March 1949.

You are well aware of the action taken by the Agricultural Department for stepping up food production by better manure, improved strains of seed, control of pests and diseases and use of tractors and other agricultural machinery, The failure of monsoon in two successive years has upset many calculations and in spite of all that has been done, the food problem continues to be a matter of anxious concern. Imports of food grains are being got by the Government of India from foreign countries. Exorbitant prices have to be paid for this purpose on account of international profiteering in the sale of foodstuffs. The cost of these imports has been going up every year since 1946. In 1948, 2.1 million tons had to be got at a cost of Rs. 130 crores. This year, imports up to 4 million tons may be required and this would cost Rs. 175 crores. These imports are a great drain on our exchange resources which are badly needed for getting our industrial requirements. The Central and Provincial Governments have to pay huge sums as subsidies for bringing down the prices of imported grains to the level of the prices in this country. The net result of last year's food imports was a loss to the exchequer of Rs. 32 crores. The money thus spent on food imports and the losses incurred cut into the funds which could be utilised for nation-building

schemes. As stated by our Prime Minister, Pundit Nehru, food has become our basic problem upon the solution of which depends the whole economic development of this country on healthy lines. Government have become aware of the gravity of the foreign exchange problem and of the disorganisation of our national economy. They have, therefore, decided to stop the imports of foodgrains from abroad after 1951.

In 1940, agriculture was put on something like a war-footing in Britain and this helped them to counteract the U-Boat campaign. Three months ago Lord Boyd Orr came here on the invitation of the Government of India to study our food problem. He has recommended that the food problem should be tackled on a war basis, as Britain did in 1940, by cutting the red-tape attached to normal departmental procedure and setting up a machinery at the Centre as well as in the Provinces to secure quick decisions and speedy implementation. He has also pointed out that the equipment, fertilisers, executive staff and finance needed for this special drive should be provided to the extent possible. The Central Government have accepted his recommendations. Our Prime Minister and Governor-General have broadcasted an appeal to the nation to make an all-out effort to obtain self-sufficiency in food by 1951 and to ease the whole economic position. A concerted drive has been started for this purpose. A Food Commissioner with considerable powers to act speedily and effectively has been newly appointed at the Centre and a Food Production Board has been formed to assist him. He will deal directly with the Commissioners of Food Production set up in the provinces for carrying out the programme of increased food production. The Central Ministry of Agriculture have promised to allot a larger quota of iron, steel, etc. for agricultural purposes and to expedite their supply. The Economic Commission for Asia and the Far East are expected to send to this country increased supplies of Agricultural Machinery, fertilisers and the material required for irrigation projects. Agriculturists who achieve high success in increasing the yield of food grains will be awarded special medals and prizes. The revised food plan to be implemented in Madras in 1949-50 and 1950-51 is estimated to cost Rs. 34½ crores. In this are included P. W. D. schemes costing Rs. 7 crores, agricultural schemes costing over Rs. 21 crores, well subsidy schemes costing Rs. 3 and odd crores and tank improvement schemes costing Rs. 3 crores. The net cost of these schemes to Government will be 16.78 crores, of which 10.50 crores will be the Provincial Government's share and the rest will be borne by the Government of India. The estimated additional production in tons from 1947-48 to 1950-51 is a little over 12 lakh tons.

Our agricultural statistics being defective, it is not possible to correctly gauge the food situation in the country. It is contended in some quarters that much of the present trouble is due more to the control machinery than to food shortage. There is no doubt that procurement is

unpopular with the ryots. The existence of rigid control is not conducive to increased food production which is the real remedy against the present unsatisfactory state of affairs. There is a proposal to have a levy scheme excluding from procurement smaller holdings. This will minimise complaints from the large class of smaller ryots regarding harassment from procurement officers. The reintroduction of statutory rationing and informal rationing on a country-wide scale necessitates larger imports which the country cannot afford at present. The Government of India seem to be veering round to the view of the Madras Government and considering restriction of rationing to areas where they are really needed. This will reduce our ration commitments.

Agriculture being our premier industry, the prosperity of the agriculturist is essential for the general prosperity of the land. There can be no incentive to increased production so long as the cultivator is not able to get economic prices for his surplus produce. He prefers the growing of more remunerative commercial crops and in many places money crops are being grown instead of food crops. The prices now fixed for food-grains in Madras seem to have given some satisfaction to the ryots. The improvement of procurement this year is due to the increase given in prices The Madras prices are moderate compared with the prices in other provinces. If the Government of India pursue their policy of reduction of prices, it will defeat the present attempts made for increasing food production. The Food Conference which will be meeting at Delhi on the 1st and 2nd of August will, I hope, come to right decisions regarding the question of restricting rationing and fixing remunerative prices for food-grains so as to ensure a fair return to the cultivator.

Next to water, manure is the most important single factor for increasing food production. The supplies of artificial fertilisers and groundnut cake being short of our requirements, we have to make full use of the organic manures which can be made more early available to ryots everywhere. The green manure drive should be continued with greater vigour. The ryots in every village should be instructed in the proper method of preparing farm yard manure and storing and using it. The planting of quick-growing fuel trees will supply alternative fuel and help to some extent in putting an end to the prevalent practice of using cattle-dung cakes as fuel. The National Tree Planting Week inaugurated in August last in response to the appeal issued by the Hon. Sri Jairamdas Doulatram is meant to replenish fuel supplies and conserve stocks of farmyard manure for increasing soil fertility. The agricultural officers should secure the co-operation of people in every district and organise the second Tree Planting Week next month in a successful manner in as many places as possible. The development of compost making in urban and rural areas will contribute to large-scale manurial production. A Provincial Compost Development Officer has been appointed to look after efficient

production and distribution of compost to ryots. Sixty-two municipalities and 47 panchayats have so far taken to compost making. Government expect all local bodies to take up compost manufacture and help food production. In the villages ryots can convert vegetable wastes and farm wastes into useful manure and a subsidy of Rs. 1 per ton will be given to the manucturer of village compost.

The question of subsidiary food production has been taken up in right earnest by the committee appointed by the Central Government for this purpose last month. Three Development officers will investigate factors affecting large-scale production of sweet potato, tapioca and banana which are believed to give larger units of calories per unit area. One of these officers will deal with the scheme of work in South India. You must have read of the experiments that are being made at Delhi and in Madras as regards the keeping quality and palatability of mixtures of sweet potato and tapioca with groundnut flour and the processing of groundnut flour. The Prime Minister and the Governor-General have appealed to the people to reduce the consumption of the basic cereals of rice and wheat and substitute them with supplementary foods to the extent possible. The well-to-do classes may well set an example in this matter.

The money spent for Agriculture bears the proportion of As. 12 to Rs. 100/- in the budget of the Central Government. Provincial Governments also have been niggardly in their expenditure on Agriculture, though it is a provincial subject. The allotment of Rs. 1·36 crores for Agriculture in the Madras budget forms only 2·4 per cent of the total expenditure. Now that food production has been given top priority, Government will have to spend more money and employ more men for the development and improvement of agriculture. With a view to make agricultural education sufficiently attractive, Government have passed an order last month recognising the B. Sc. degree in Agriculture as equivalent to the B. A. or B. Sc. University degree in this Province for purposes of appointments in any department of Government.

Governmental effort by itself is not enough for the success of the food drive. The enthusiastic co-operation of the people must be enlisted and it must become a nation-wide campaign. More than anything else, it is important to contact the farmer, convince him, and make him join whole-heartedly in working the food plan. Scientific knowledge and advice must reach the man behind the plough. The Government of India propose to organise an extension service to carry the results of research to the fields and to enlist the active support of farmers in the activities of Government in the matter of increased food production. The F. A. O. has been requested to lend the services of an expert in extension service

to advise Government in carrying out their intention. It is no easy job to approach the ordinary cultivator and make him adopt modern scientific methods of agriculture. The majority of agriculturists in this country cultivate tiny plots of land. Their resources are small. Being illiterate and poor they have neither the desire nor the means to adopt present-day farming practices. The exhibition which has been organised here is one method of arousing the interest of people in the activities of the Agricultural Department. Leaflets, articles in newspapers, films, broadcast talks and exhibitions are all good in their own way to educate the farmer. But there is nothing to beat the demonstration on the farm. In a country where illiteracy is widespread, as it is in India, effective propaganda must be based mainly on ocular demonstration. The gospel of good husbandry can be most easily taught by taking the ryot to see with his own eyes the results of new methods on the plot of any farmer who does his job particularly well.

Any long-term food policy must go along with a planned population policy. The rapid growth of population is creating a serious food problem all over the world. The population in the Indian Dominion is increasing at the rate of 4 millions a year and in our province we are adding to our population a little over half a million per year. The problem of balancing population and food supply must be a matter of deep concern to the Government and the people in our country. Steps will have to be taken to control the rate of population growth by adopting the practice of family limitation. Attention has been drawn to this matter by the Famine Enquiry Commission but so far little or nothing has been done in this direction.

The personal example set by Rajaji in helping to plough the estate of his residence and by Pundit Nehru in raising food crops and vegetables in his compound are meant to show their earnestness in solving the food problem. Both of them have made a special appeal to congressmen to lead a movement for food-growing. Nehru has rightly said that this co-operation in a mighty drive for food production is ultimately a war against poverty and ignorance, against mal-nutrition and high prices. Congressmen have responded to such calls from national leaders at many a time of national emergency. The tremendous determination and the great spirit of service and sacrifice displayed by congressmen in winning the Battle for Independence must now be shown in fighting the Battle for Food and making this country independent of foreign imports. By taking up this campaign, the Congress organisation can establish mass contact, revitalise itself and keep up its hold on the minds of millions of people in this country. The new slogan "Produce or Perish" must take the place of the old call to "Do or Die". There will then be a new spirit abroad in the countryside and the attempt to increase food production is bound to achieve much greater success than it has done in the past.

Opening of the Discussion by Sri R. M. Sundaram, I. C. S., the Director of Agriculture

I have great pleasure in welcoming the Honourable Minister for Agriculture and all of you to this Conference. It has been the practice at these conferences to consider one of the vital problems affecting our country on the agricultural side. The subject chosen for to-day's discussion is "How best to translate the results of Research into General Farming Practices" A number of officers of the Department have submitted papers on this subject and ten of them will be read to-day. There will be a general discussion which will follow this. Non-officials are requested to offer their opinions and then those officials who had not read papers will be invited to offer their views. As the time at our disposal is short, no speaker will be allowed more than 10 minutes.

Coming to the subject of the Symposium, I wish to offer my own views in a brief manner. There has been a long-standing complaint that in India, Agricultural Research has advanced very far, but the cultivators have not kept pace with Research and that adequate arrangements do not exist to translate into practice all the theory that we preach. This criticism seems to be justified to a large extent. The entire aim of the Department should be to enlighten the ryot by propaganda in suitable forms. At present, the Department carries on its propaganda by (1) printed literature, (2) demonstration on the field and (3) by contact with ryots in the shape of talks, lectures, radio programmes, etc. The high percentage of illiteracy in India is a severe handicap to the first form of propaganda. Demonstration in ryots' lands and in our Research Stations have been carried on vigorously. The radio is an effective means of dissemination of knowledge, but the number of villages owning radio sets is very limited. Our staff maintains close contact with the ryot, but its strength is not adequate for the purpose. One demonstrator with a few fieldmen and maistries is in charge of taluk with over 100 villages and is hardly able to visit more than one village per day. He is saddled with depots under "State Trading Schemes" (selling seeds, manures, etc. and accounts). The expenditure under the Agricultural Budget of our Province is about 1·30 crores which is only 2·4 per cent. of the total revenues of the Province. Unless this field staff is doubled at least, we cannot possibly cater to all the villages in the Province in a satisfactory manner.

The Madras ryot is no doubt conservative, but I claim that he is a shrewd individual and would not turn down any proposal to increase his yield per acre. It has been stated that apart from his illiteracy, the poverty of the ryot and the system of land tenure resulting in uneconomic holdings are responsible for his apathy. The Zamindari system and Absentee landlordism are also said to be responsible for the moribund condition of agriculture. While these may be true and account for the

fact that a tenant does not wish to make permanent improvements to the lands he cultivates, no ryot would be unwilling to get a betttr return for his toils. It is therefore clear that Departmental propaganda is sure to succeed if organised on proper lines. Ryots have to be tackled in person through meetings, lectures, radio talks, posters, exhibitions and dramas. Good advertisement of the work done in Research Stations is bound to attract notice.

The human element is very important in propaganda. The staff would do well to study the state of mind of the ryot he has to tackle and shape his publicity methods accordingly. To provide adequate training in propaganda methods, the final year Agricultural Students are now given a course of lectures on the theory and methods of propaganda. This would enable the students to develop their propaganda work on a rational basis.

At present, the Department has the following methods: (1) News letter every month. (2) Departmental Journals, Mezhichelvam, etc., in regional languages. (3) Administration report of the Department by Director of Agriculture. (4) Leaflets. (5) Pictorial Posters. (6) Monographs on certain crops. (7) Popular accounts of work done in the several Agricultural Research Stations. (8) Running Demonstration Plots in Ryots lands. (9) Exhibitions. (10) Press talks by Departmental Officers on particular matters of topical interest like outbreak of pests and diseases, cultivation of certain crops, extension of irrigation facilities, etc. (11) Radio talks by our officers.

There is now a proposal to purchase eight propaganda vans fitted with full equipment of library, specimens of improved seeds, sound films projectors, loud speaker equipment etc. It is also proposed to take documentary sound films of Department activities to be shown at various gatherings, exhibitions, etc.

Extension Service: In the United States of America there are country agents of the Agricultural Department who do valuable propaganda. There are enlightened ryots who have adopted improved methods advocated by the Department and they in turn tour the villages and induce ryots to follow them. The Government of India are inviting certain experts from U. S. A. to advise us in devising a similar plan for India.

Prize Schemes: The periodical holding of exhibitions and awarding prizes for the best cultivator or the ryots who have adopted improved methods of cultivation are also under contemplation. This would help to give publicity to the activities of the Department.

It is notorious that in India yields have always been poor. Climatic and soil conditions no doubt play a very important part, but the endeavour of the scientist is to find out the causes of poor yields and the

remedies. In view of the alarming increase in population and our dependency on foreign countries for imports of food grains, the situation is worsening every year and unless we make the country self-sufficient in Food, there is no hope for the prosperity of our country. The aim of all research is to increase crop yields and the problem of translating the results of Research to the Farming practices of ryots merits serious consideration. Gentlemen, your views are invited on this problem.

LIST OF PAPERS RECEIVED FOR SYMPOSIUM ON

"Transmission of Research - How best to translate the results of Research into General Farming Practices".

1. How best to translate the results of Research into General Farming Practices — M. Kantiraj.
2. How best to translate the results of Research for the benefit of the average farmer — B. M. Lakhmipathy.
3. How facts flow to farmers in U. S. A. — S. Krishnamurthy.
4. Research and Propaganda-A plea for Re-orientation — K. C. Naik.
5. Some lessons of the Bagavadi Demonstration Farm — S. Kasinathan.
6. Transmission of Research-How best to translate the results of Research to General Farming Practices — V. Manikya Rao.
7. How best to translate the results of Research to General Farming Practices — M. Subramaniam.
8. Transmission of Research-How best to translate the results of Research into General Farming practices — Md. Khasim Adeni.
9. How best to translate the Results of Research to General Farming Practices with particular reference to sugarcane. — S. V. Parthasarathi & J. V. V. Suryanarayana.
10. Transmission of Research-How best to translate the results of research into General Farming Practices — S. A. Ebrahim Ali.
11. How best to translate the results of Research to General Farming Practices — M. R. Balakrishnan.
12. The Indian Ryot and Agricultural Research — T. B. Dasarathy.
13. Pedigree seed of Rice — Its rapid extension in the country — M. B. V. Narasinga Rao
14. How best to translate the results of Research into General Farming Practices — M. Lakshmikantham.
15. Transmission of Research-How best to Translate the Results of Research to General Farming Practices — C. Balasubramanian. & M. B. V. Narasinga Rao,

16. How to translate the findings of Research and improved methods of Agriculture to the Ryots — T. K. Balaji Rao.
17. How best to translate Research into General Farming Practices — P. L. Marasimham.
18. Transmission of Research on pest control — S. Ramachandran.
19. Transmission of Research-How best to translate the results of Research into General Farming Practices — A. Kunhikoran Nambiar.
20. Means to enforce Research-Finds — K. Sankaraiah.
21. How best to translate the results of Research into Farming Practices — M. P. Sankaran Nambiar.
22. Results of research their application to General Farming practices with special reference to sugarcane — C. Ekambaram.
23. Publicity in Production — G. Satyanarayana.

PAPERS OF GENERAL NATURE.

1. Crop planning under the Tungabhadra Project — S. Kasinathan.
2. Some useful plants for green manure purposes for the saline tracts of the Presidency — S. N. Chandrasekharan & C. Rajasekhra Mudaliar.
3. How the chemistry section helps the farmer — P. D. Karunakar.
4. Increasing fruit production through better facilities for reproduction — J. Subramaniam.
5. Possibilities of growing more food on the Deltas of the Northern Circars — C. V. Sarvayya Chetty.
6. Rice Culture in countries with high yields–its lessons for Madras — M. B. V. Narasinga Rao.
7. Fodder problem in Madras — S. N. Chandrasekharan & Daniel Sundaraj.
8. Some aspects of the Fodder problem on the Madras Presidency — T. Venkataramana Reddi.
9. The interactions of the productive Factors in Rice — M. Satyanarayana.
10. Utilization of fruits and vegetables — Dr. G. S. Siddappa.
11. A short resume of plant protection, its present, past and future. — V. Tirumala Rao.
12. The Imminent urgency for propaganda in the grow more food campaign — C. S. Seshagiri Iyer.
13. Water Hyacinth-A Problem — do.

PAPERS OF TECHNICAL NATURE.

1. Deficiences of minor elements responsible for diseases of crop plants in S. India — D. Marudarajan.
2. Varieties and Forms of coconuts — G. V. Narayana.
3. The Phosphoric Acid content of some raw and parboiled rice samples — M. R. Balakrishnan & D. Narayana Rao.
4. Embryo culture and its use in plant breeding — P. Uttaman.
5. Stem Borers of sugarcane in Madras Presidency and their control — C. Krishnamurthy.
6. Field Trials of Gammexane against Paddy grasshoppers — N. Sobanadri.
7. The ocurrance of *Stomaxys calcitrus* L. as a serious pest of cattle in the river side villages of Cuddapah District during musk melon season — C. S. Balasubramaniam.
8. Commerical plant-hormone products-a brief survey — L. Venkata Ratnam.
9. A study of the composition of well waters in and around Bapatla — M. R. Balakrishnan & D. Narayana Rao.
10. Natural crossing in cumbu, *Pennisetum typhoides*, Stapf and Hubbard — P. Krishna Rao.

Report of the Managing Committee for the year 1948—'49.

(Presented to the General Body)

The Managing Committee presents the following report of the activities of the Union for the year 1948—'49.

Membership: The strength of the Union as it stood on 31st July was 961 as against 731 of last year and 510 year before last. It is gratifying to note that this is the highest membership on record ever since the inception of the Union, still a large percentage are outside the Union despite our appeals sent to many officers. The increase in membership is partly due to the joining of the students of the Agricultural College, Bapatla, as members of the Union and in this connection the Union thanks Rao Bahadur Sri P. V. Ramiah, Principal. Messrs. M. R. Balakrishnan and T. Nataraj for the interest evinced by them in the welfare of the Union. The members on roll would have been much more but for the painful duty which the Managing Committee was forced to take effect discontinuance of the membership who were in arrears of subscription for over three years. We take this opportunity to appeal to all the officers who were not members already to enlist themselves as members and help the Union in enlisting members in the future. We would also request the students who pass out of the colleges to continue their membership.

Officer bearers: During the year the Manager Sri T. V. Subramaniam and the Treasurer Sri G. Rangaswami resigned their posts consequent on their transfer outside. Sri S. Muthuswami was co-opted as Manager in the place of Sri T. V. Subramaniam.

General Body Meeting: There was a General Body Meeting of the Student Members of the Union on 20—1—'49 to consider about the Government Order for requesting the student members to increase their subscription from Rs. 2/- to Rs. 3/- and this was readily accepted by them for which we are thankful to them.

Meeting of the Managing Committee: 15 meetings of the Committee were held during the year.

The Madras Agricultural Journal: The Journal continued to be published with unfailing regularity and promptness.

Editorial Board: 10 meetings of the Editorial Board were held during the year. A good number of articles on various subjects were received for publication in the journal and we have great pleasure to record our thanks to the various authors who have contributed to the success of the journal. We appeal once again to the officers of the Department to evince greater interest in the journal by sending more popular articles to help the countries' progress of scientific agriculture. The monthly publication of "*Hints to Farmers and Agricultural News Letter*" in the journal are the new features introduced during the year and we are glad that the contributions are appreciated by our readers.

We have great pleasure in recording our thanks to Mr. C. S. Krishnaswami, Editor and to other members of the Editorial Board for the able and efficient conduct of the journal during the year. We record our appreciation of the promptness of our printers, The Coimbatore Co-operative Printing Works, Ltd., Coimbatore - and with their co-operation and interest the publication of our journal has been made easy.

Subscribers: The number of non-member subscribers to the Journal during the year was 200. Discontinuation of the despatch of journal for non-payment of subscription for over three years was done from the beginning of this year and this has accounted for reduction of subscribers to the journal. Due to high cost of printing and paper the managing committee has resolved to increase the subscription of the journal from Rs. 4/- to 6 and this needs now your approval. We wish to invite the attention of the moffusil members that they would be rendering a great service to the Union if they would help in enlisting more subscribers.

Finance: The Managing Committee records its gratitute to the Government for the ready help in granting us the increased subsidy for the journal Rs. 1,800/- from Rs. 400/- with this year 1948–'49 on wards. The auditors' report and financial statement are before you. Our finances have improved due to continuous collection of all arrears due from 1945 onwards. The committee has canvassed a number of advertisements during the year and increased its finances during the year. A sum of Rs. 500/- was added to the fixed deposit as Reserve Fund for the Union. A sum of Rs. 400/- was spent for building and furniture repairs to the Union, as these were not done for many years.

Ramasastrulu Munagala Prize: We have to record with regret that the response for the Ramasastrulu prize was meagre this year also. Only two essays were contributed. We regret to report that the committee of judges, who at our request scrutinized these two essays declared that neither of them merited the award of the prize.

Acknowledgment: Now it is our pleasant duty to convey our thanks to the various members of the Union who have helped in different ways during the period under review. We are specially thankful to Mr. M. C. Cherian, our ex-officio president for his keen and sustained interest and sympathetic attitude in all union activities and to Mr. P. V. Ramiah, Principal, Agricultural College, Bapatla for his help to our Union in all activities concerning that College. To Mrs. R. N. K. Sundaram, our thanks are due for distributing the sports prizes last year. We have pleasure in recording our grateful thanks to the convenors and members of the various committees who whole-heartedly helped in celebrating the College Day and Conference last year.

General Body Meeting.

Proceedings of the General Body Meeting of the Madras Agricultural Students Union. The business meeting was held on the 31st July 1949 at the Research Institute with Sri M. C. Cherian, ex-officio President in the chair. The report of the Managing Committee for the period 1948–'49 was presented and approved. The auditors' report was then discussed and was passed with a minor ammendment. The resolution tabled by Sri C. Balasubramania Mudaliar was considered and passed with an ammendment. In accordance with the above the revised rates of subscription become (i) all student members Rs. 3/- each (ii) officers with salary of Rs. 100 - 250/- Rs. 4/- and (iii) those with salaries of Rs. 250 and above Rs. 6/- a month. Two resolutions given notice of by the student members were unanimously passed and recommended for immediate communication to the proper authorities. The election of the Office bearers for 1949 - '50 was then gone through. The list of elected numbers is appended in the cover page. With a vote of thanks to the retiring committee proposed by Sri V. T. Subbiah Mudaliar and with a short address by the newly elected vice-President Sri P. Krishna Rao the meeting terminated.

List of prize winners in 1948.

Name of Winner.	Name of Medal.	Description of Prize.
A. Appa Rao	Robertson Medal	For Agriculture
S. Muthuswami	Glogstoun Medal	For General proficiency.
A. Appa Rao	Kees Medal	For Agricultural Chemistry.
A.Appa Rao	Raghunatha Rao Medal	For practical Agriculture.
G. Rajagopalan	D'Silva Memorial Medal	For Animal Hygiene.
H. Poornapragnachar	Goshen Medal	For Agri. Zoology.
V. Muthiah	Anstead Medal	For Plot cultivation.
A. Venkataraman	K. S. Venkatarama Ayyar Medal	For Highest number of marks in the First examination.
D. Meenakshi-sundaram	Sampson Memorial Medal	For Agri. Botany.
D. Meenakshi-sundaram	Dev. Bah. L. D. Swamikannu Pillai Medal	Highest in all the three examinations.

College – Day Sports, 1949

LIST OF PRIZE WINNERS.

Champion of the year 1944—V. N. LAKSHMANAN.

Cross Country Race: (5 Miles)
(The Norris Cup)
1. Kalliappan, R.
2. Krishna Alwa, H.
3. William Paul.

Pole Vault:
1. Shanmugam, C T.
2. Ratnaswami, M. C.
3. Yeshvant Ail.

100 Metres Dash:
(The Saidapet Old Boys Cup)
1. Lakshmanan, V N.
2. Raman, S
3. Balakrishnan, V.
(New Record)

Shot Put: (16 lb.)
1. Krishna Alwa, H.
2. Lakshmanan, V. N.
3. Appiah, K. M.

200 Metres Hurdles:
1. Lakshmanan, V. N.
2. Balasubramaniam, V.
3. Francis, S. P.

Long Jump:
1. Balakrishna Alwa, K. N.
2. Ramiah, S. M.
3. Lakshmanan, V. N.

Cricket Ball Throw:
1. Ranganathan, P.
2. Duraiswami, R.
3. Balakrishna Alwa, K. N.

110 Metres Hurdles:
(The Ramaswami Sivan Cup)
1. Lakshmananan, V. N.
2. Francis, S. P.
3. Ranganathan, P.
(New Record) Time 19 2/5.

High Jump:
(The Tadulingam Cup) 4' 10"
1. Ranganathan, P.
2. Lakshmanan, V. N.
3. Paramanandam, P.

Invitation Race: (800 Metres):

1. Chinnaswami, S.
   Municipal High School,
   R. S. Puram.
2. Natarajan, K. A.
   St Micheels' High School.
3. Sankaran, C.
   Govt. Arts College.

Hop Step and Jump:
(37'. 2½ New Record)

1. Paramanandan, P.
2. Ranganathan, P.
3. Lakshmanan, V. N.

400 Metres Race:

1. Kolandaswami, S.
2. Shanmugam, C. T.
3. Rajagopalan, T. V.

Javelin Throw:

1. Appaiah, K. M.
2. Yeswant Ail.
3. Ramamurthi, K. V.

1,500 Metres Race:
(The Anstead Cup)

1. Kaliappan, R.
2. Ayyaswami.
3. Mahalingam.

Old Boys Race: (Handicap)

1. Jayaraj.
2. Varadarajan, S.

4 x 400 Metres Relay Race
The Chunnampet Shield.
(Intertutorial)

1. P. D. Karunakar's Wards
2. V. T Subbiah Mudaliar's Wards

Tug of War: The Ramnad Shield.
(Inetertutorial)

1. R. Balasubramaniam's Wards.
2. V. T. Subbiah Mudaliar's Wards.

Obstacle Race:

1. Balasubramaniam, V.
2. Yeswant Ail.

Crop and Trade Reports

Cotton Raw, in the Madras Presidency: The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February, 1949 to 29th July, 1949 amounted to 250,047 bales of 392 lb. lint as against an estimate of bales of the total crop of 1949. The receipts in the corresponding period of the previous year were 287,475 bales. 333,531 bales mainly of pressed cotton were received at spinning mills and 2,835 bales were exported by sea while 65,324 bales were imported by sea mainly from Karachi and Bombay. (From Director of Agriculture, Madras)

Weather Review — For July 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	3·3	−3·9	6·0
	Calingapatam	3·0	−2·5	7·5
	Vizagapatam	2·5	−1·9	12·2
	Anakapalle*	3·8	−1·2	12·4
	Samalkot*	14·3	+8·2	20·0
	Kakinada	15·2	+8·6	25·3
	Maruteru*	11·3	+4·1	20·0
	Masulipatam	15·5	+9·1	21·8
	Guntur*	9·7	+3·7	19·8
	Agrl. College, Bapatla	12·3	+7·6	18·3
	Veeravanam (College Farm)	10·7	(x)	16·0
Ceded Dists.	Kurnool	4·8	+0·4	13·3
	Nandyal*	6·0	+0·9	14·8
	Hagari*	0·6	−0·7	5·2
	Siruguppa*	1·9	−1·1§	7·5
	Bellary	0·4	−1·2	4·4
	Rentichintala	5·0	+0·2	16·1
	Cuddapah	6·7	+2·6	13·7
	Anantharajpet*	9·9	+5·7	18·3
Carnatic.	Nellore	5·2	+2·4	16·2
	Buchireddi-palem*	6·9	+4·9	14·4
	Madras	2·9	+0·7	15·8
	Tirurkuppam*	6·9	+1·9$	20·9
	Palur*	5·2	+2·0	16·0
	Tindivanam*	3·7	+1·0	9·8
	Cuddalore	7·7	+5·1	16·2
Central.	Vellore	8·4	+3·8	20·5
	Gudiyatham*	6·4	+3·7	17·1
	Salem	2·7	−1·1	16·0
	Coimbatore (A. C. R. I.)*	3·0	+1·5	7·4
	Coimbatore (C. B. S.)*	3·5	+1·8	7·6
	Coimbatore	3·0	+1·3	8·3
	Tiruchirapalli	4·5	+3·4	11·4

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	3·0	+1·3	8·2
	Aduturai*	2·4	+0·8	8·5
	Pattukottai*	5·8	+2·9	9·3
	Mathurai	4·6	+2·6	17·3
	Pamban	Nil	−0·5	8·7
	Koilpatti*	2·0	+1·5	10·0
	Palamcottah	1·6	+1·3	11·5
	Amba-samudram*	0·7	Nil	6·6
West Coast.	Trivandrum	11·1	+3·3	37·4
	Cochin	29·1	+5·8	78.9
	Calicut	39·8	+5·5	97·5
	Pattambi	27·1	+1·4	68·7
	Taliparamba*	50·4	+1·6	102·5
	Nileshwar*	45·3	+4·2	116·7
	Pilicode*	50·6	+8·0$	109·6
	Mangalore	50·7	+11·3	118·8
	Kankanady*	51·5	+12·8	118·0
Mysore & Coorg.	Chitaldrug	1·0	−1·9	6·3
	Bangalore	13·8	+9·9	21·2
	Mysore	4·5	+1·8	15·7
	Mercara	37·8	−5·3	69·7
Hills.	Kodaikanal	8·4	+3·7	21·6
	Coonoor*	6·0	+3·6	16·9
	Ootacamund*	6·5	+0·6	23·3
	Nanjanad*	9·0	−0·2	20·4

Note :— (1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal

(3) x Readings are being recorded only from February 1948.

(4) § Taluk office normal is 3·04", and Rainfall is 2·30".

(5) $ Average of six years data for Tirurkuppam, and seven years data for Pilicode is given as normal.

Weather Review for July 1949.

The monsoon was fairly strong from 1—7—1949 to 9—7—1949 resulting in widespread and localised heavy rains in Malabar and the South Konkan. It became feeble on 10—7—1949; but the very next day, it regained activity due to the unsettled conditions in the Bay. Its subsequent vigour was due to two causes, namely (i) the crossing of a low pressure wave over the Orissa Coast and (ii) the formation of a trough of low pressure over the Central Arabian Sea. The vigour was maintained upto 17—7—1949 and then it again became feeble on account of the shifting of the seasonal trough towards North, away from the normal position. A week later the monsoon again became active owing to the shifting of the seasonal trough closer to the normal position. Thereafter the activity of the monsoon was maintained right upto the end of the month, the reason being the continued unsetttled conditions in the Bay.

As per the rainfall forecast for the months of August and September, issued by the Meteorological Office, Poona, there is a four to one chance that the total rainfall in these two months will be slightly above normal in the Peninsula.

The note-worthy falls in the month are given hereunder:—

Date	Place	Rain fall in inches.	Remarks.
13—7—1949	Mangalore	3 2	Only falls above
14—7—1949	Mangalore	3·3	3 0 inches are given
15—7—1949	Alleppey	5·9	in this table
,,	Palghat	4·2	
,,	Calicut	3·8	
,,	Cochin	3·7	
16—7—1948	Calicut	9·9	
,,	Kakinada	4·1	
17—7—1949	Mangalore	3·3	
21—7—1949	Arogyavaram.	3 3	
,,	Bangalore	4 1	
23—7—1949	Cuddalore	4·0	
26—7—1949	Mangalore	4·4	
28—7—1949	Minicoy	4·0	
30—7—1949	Mangalore	5·4	

M. B. V. N. & C. B. M.

Departmental Notifications

GAZETTED SERVICE—POSTING AND TRANSFERS.

Name of officers	From	To
Sri C. M. John,	On leave,	Oilseeds Specialist and Vice-Principal, Agri. Coll., Coimbatore.
,, Narayanan Nair, P.	D. A. O., Ooty,	Special, D. A. O., Coimbatore under the Govt. Agri., Chemist.
,, Raman Rao, V.	D. A. O., Saidapet,	D. A. O., Anantapur.
,, Suryanarayana, V.	On leave,	D. A. O., Ootacamund.
,, Sivaswami, E. G.,	D. A. O., Under Training,	D. A. O., Saidapet.

SUB-ORDINATE SERVICE.

Appointments—Posting and Transfers.

Sri M. Giri Raj, an Overseas Scholar is appointed as Technical Assistant in connection with the enforcement work of the Fruit Products order.

The following appointments of soil Conservation assistants have been sanctioned for one year for the scheme of Contour Bunding and Contour Trenching in the Ceded districts

Sri Antony Reddy, Y., A. D., Mr. Abdul Kareem Sahib, A. D., Siruguppa; Sri Jagannatha Rao, P., Assistant in Millets, Koilpatti; Sri Kondayya, B., Assistant in Chemistry, Coimbatore; Sri Muhammad Abdul Basheet Sahib, A. D., Koilkuntla; Sri Prahlada Rao, A. D., Penukonda, Sri Narasimha Reddy, A. D., Kalahasti; Sri Narayanaswami, V., A. D., Hindupur; Narasimha Reddy, R., A. D., Proddattur; Sri Radhakrishnamurthi, K., Assistant in Millets, Coimbatore; Raghunada Reddy, D., A. D., Krishnagiri; Sri Rangamannar, D., F. M., Siruguppa; Ramalinga Reddy, K., A. D., Tirupathur; Sri Suryanarayanamurthi, H. A. D., Madkasira; Sri Satyanarayana Raju, Assistant in Chemistry, Coimbatore; Sri Satyanarayana Rao, K., Assistant in Chemistry, Coimbatore.

The following B. Sc. (Ag.) graduates are appointed as Upper sub-ordinates and posted for training in Entomology and Mycology at Coimbatore:—

Bharathan, P. — Mathurai; Gnanavaram, I. — Mathurai, Jayaraja, R. — Tanjore; Perumal, K — Tirunelveli; Pinagapanui, N. — Chingleput; Selvarangaraju, G. — Coimbatore.

On the completion of their Diploma Course in Horticulture at Madras the following subordinates are appointed to posts noted against each.

Name of officers	To
Adivi Reddy, A.	Nursery Assistant, F. R. S., Kodur.
Bakthavathsalu, C. M.	Fruit Assistant, Banana Scheme, Aduthurai.
Dasaratharamiya, V.	Fruit Assistant, Kodur.
Kothandaraman, E.	A. D., Vegetable Government House Farm, Madras.

Name of Officers	To
Kuppuswami, B. S.	Fruit Assistant, Kallar and Burliar Gardens.
Krishnamurthi, P. A.	Fruit Assistant, Fruit Farm, Tindivanam.
Muddanna Shetty, H	Horticultural Assistant, Coimbatore.
Narasimham, B.	Horticultural Assistant, Agricultural College, Bapatla.
Narasimhamurthi, D.	Fruit Assistant, S R S, Anakapalle.
Prabhakara Reddy, G	Fruit Assistant, Fruit Farm, Siruguppa
Padmanabha Raju, B.	Special A D, Crop Cutting Experiments, Kakinada.
Ramalingam, V.	A D., Attur.
Ramachandran, T K.	Fruit Inspector, Kodur
Raman, K. R	F M, L R. S., Hosur Cattle Farm.
Sankarasubramaniam, T K.	Special A. D., Tobacco Scheme
Subramaniam, J.	Fruit Assistant, Kodur.
Sampath, V.	Fruit Assistant, Fruit Farm, Tirurkuppam.
Tejappa Shetty, K.	Fruit Assistant, Waynad Colonization Scheme.
Venkataraman, T M	Fruit Assistant, F. R S., Coonoor

The following Upper subordinates have been selected to undergo the diploma course in Horticulture at Madras for a period of one year from 14th August 1949

Names	
Azimuddin, A.	A D, Hosur
Bettai Gowder R	Assistant incharge Kallar and Burliar Gardens, Mettupalayam
Krishnan, L.	Agricultural Instructor, Agricultural Training Orthanad.
Madhava Rao, V. N.	Horticultural Assistant, Coimbatore
Nanjappa Maniyagar, V.	F. M., L. R. S., Hosur.
Narayanamurthi, R.	A D, Elluru.
Padmanabhan Nambiar, K.	Fruit Assistant, Agricultural Farm, Waynad
Ramasomayajulu, M V	F. M, A. R. S., Samalkotta.
Ramanathan, R.	A D., Vegetable Scheme, Madras.
Shanmugam, T. S.	A. D, Elayirampannai.
Sambasiva Rao, I. K.	Fruit Assistant, Coonoor.
Samuel Sundara Raj, J.	Nursery Assistant, A R. S, Kodur.
Subba Rao, K.	F. M., A. R. S., Siruguppa.
Sambamurthi, K	Assistant in Fruit, Sugarcane Research, Station, Anakapalle
Venkata Raja Rao, N.	Marketing Assistant, Kakinada
Venkatachalam, C.	A. D., Crop Cutting Experiments, Kakinada

Private Candidates.

Balu, V.	Madras.
Krishnaswami, A. R.	Madras.
Ramakrishnan, V.	Villuppuram.

The following have been selected to undergo the certificate course in Horticulture for one year from 14th August 1949.

George, P Fieldman Government Seed Depot, Madras.
Murthi, P. D. Fieldman Government Seed Depot, Madras.
Palanikumaraswami, P. Fieldman, A. D., Office, Tirupattur.
Panichlaiah, P. Fieldman Kovur.
Palatla Venkateswara Rao, Kotha Agraharam (Private candidate—Stipendiary)
Subba Reddi K. Fieldman, A. D, Office Kurnool.
Venkatanarayana, P. Fieldman, A. D, Office, Dharmapuri
Vaidianathan, L. R. Fieldman, A. D., Office, Lalgudi.

The following B.Sc (Ag) graduates are appointed as upper subordinates and are posted to the vacancies shown against each.

Names	To
Balasundaram I	A. D. Palladam.
Chockalingam, M.	Assistant in Cehmistry, Coimbatore.
Chennabasavaiah, H. S. M.	F M Sugarcane Liaison Farm, Hospet.
Chandrasekharan, S.	A. D. Ponneri.
George, P. F.	Assistant in Chemistry, Coimbatore.
Karuppannan, G.	Assistant in Chemistry, Coimbatore.
Koamojee, B.	A. A. Proddatur.
Nalla Gounder, S. V	A. D. Krishnagiri
Panduiangan, S. V.	F. M. Central Farm, Coimbatore.
Philip, P. K.	Journal Asst. in Malayalam, Madras.
Rajagopalan, D. S.	Cotton Assistant, Tinnies Scheme, Coimbatore
Rajagopalan, G.	Asst. in Entomology, Singampatti Tinnevelli.
Ramakrishnan, S. R.	Asst in Millets, Coimbatore.
Raghuveera Raghavalu, G.	A. D. Podili.
Rangaswami Reddiar, S.	A. D. Hosur.
Rama Rao, K.	Assistant in Chemistry, Coimbatore.
Sethumadhavan, R.	Plant Protection Asst. (Mycology) Trichy.
Sadasiva Shetty, Y.	Assisatnt in Cotton, Coimbatore.
Subbaiah, V.	Assistant In Mycology, Coimbatore.
Sankaranarayanan, R.	Assistant in Millets, Koilpatti.
Subramaniam, S	Assistant in Chemistry, Coimbatore.
Sudhakara Rao, K.	A D. Siruguppa.
Venkateswaran, A. N.	Assistant in Oilseeds, Pilicode.
Varadarajan, E. N.	A. D. Tirupattur.
Veerarayan Raja Kottakal Palace	F.M.A R.S. Nileswar.
Venkataraman. N.	Assistant in Millets, Coimbatore.
Vittal Thirukandeswaram, T. M.	A. D, Chidambaram.
Vaidyanathan, R.	Assistant in Botany, Coimbatore.
Venkateswara Rao, M.	A. D. Eluru.
Viswanathamurthi, K.	F.M-A.R.S. Siruguppa.
Vedanatham, C.	Chillies Asst. A.R.S. Guntur.
Vijayan, P. K.	Asst. Entomology, Orange Borer Scheme, Waynad.

	Names	From	To
Sri	Ananta Rao, K.	Asst. in Millets Coimbatore,	A. D. Nugur.
,,	Appa Rao, K.	A. D. Nugur,	Asst. in Paddy A. R. S. Marutueru.
,	Appalanarasimham, J.	Asst. in Chemistry, Coimbatore.	A. D. Perumbonda.
,,	Alagiriswami, M.	A. D. Kauru,	Special A. D Maruteru.
,,	Bala Bala Raju, G. J.	F M.A R.S Palur,	Special A. D. Kumbakonam.
,,	Baskara Rao, M.V.	Asst. in Chillies. A.R.S. Lam	A. D. Chintalapaudi
,,	Chintamanai, P. Y.	A. D. Chintalapudi,	A.D. Crop cutting Expert, Kakinada.
,,	Duraiswami, K. N.	A. D. Attur,	A. D. Palur.
,,	Kanakaprasada Rao, K.	F. M. Cotton Section, Coimbatore.	F.M.A R.S Samalkota.
,,	Krishnaswami Iyengar,	A. A. D. Vegetables,	A.A D Tiruvellore.
,,	Krishnamurthi, C	A. D Tiruvellore,	A. D. Vegetables, Madras.
,,	Kuppuswami, K. P.	F. M. Sims Park, Coonoor,	A. D. Palladam.
,,	Krishnamurthi, R.	A D. Ponneri.	A. D. For Sweet Potato, Ponneri.
,,	Krishnamurthi, B.	Asst. in Entomology Singampatti,	A. D. Madakasira
,,	Lingaiah, M. K.	F. M. Botanic Gardens, Ootacamund,	F. M, Sims Park
,,	Muthuswami, P.N.	A D Tirumangalam,	A. D. Mathurai
,,	Maqbaloor Rahiman Sahib	on leave	A. D. Kurnool.
,,	Manickaraj Samuel,	A. D. Sugarcane Development Work, Vellore.	A D Trichengode.
,,	Maduram, G. H.	on leave	Asst in Botany, Coimbatore
,,	Muthuswami, S.	Fruit Asst. Banana Scheme Aduthurai,	Fruit Asst. Fruit Farm, Auduthurai
,,	Murugesan, G.	A. D. Cotton Scheme, Palladam,	Teaching Asst. in Agrl. Coimbatore.
,,	Menon, K. R.	A. D. Srivilliputhur	Fruit Asst. Wynad Colonization Scheme.
,,	Mahimai Dass, V.	A. D. Kollegal	A. D. Hosur.
,,	Narasimha Ayyar, B S.	on leave	A. D. Tenkasi
,,	Nageswara Rao, M.	A. D. Virdachalam.	A. D. Markapur
,,	Naidu, S. V.	on leave	F.M.A.R.S. Siruguppa.
,,	Papa Rao, P	on leave	A.D. Nugur.
,,	Pinto, B. M.	on leave	F.M. Botanic Cardens, Ooty.
,,	Ratnakar Batkal,	A. D. Coondapur	F.M.L.R.S. Hosur.
,,	Rama Rao, B. K.	A. D. Karkal	A D. Kollegal.
.	Rama Doss, A.	A D., Kumbakonam,	P. A., to D. A O., Tanjore
,,	Ramakoteswara Rao, G.	Asst. in Oilseeds, Pilicode,	A. D, Koilkuntala.
,,	Ramachandra Rao, T.	Asst. in Botany, Coimbatore,	A. D., Hindupur.
,,	Srinivasan, T.	Agricultural Instructor Gandhi Basic Training School, Coimbatore,	Agricultural Instructure Agricultural Training School, Orthanad.

Names	From	To
Sri Sivaramakrishnaya, Y.	A. D., Salur,	A. D., Bimilipatam.
,, Srinivasagopala, D.	P. P. A., (Mycology) Tiruchirapalli,	P. P. A., (Entomology) Tanjore.
,, Srinivasan, S. R.	A. D., Trichengode,	A. D., Sugarcane Development Work, Vellore.
,, Sivasubramaniam, T.	A. D., Chidambaram,	A. D., Tindivanam.
,, Srinivasa Rao, K.	Asst. in Mycology, Coimbatore,	Cotton Asst. Hagari.
,, Srinivasalu, K.	A. D., Cotton Scheme, Palladam,	A. D., Kalahasti.
,, Subbaiah Pillai,	A. D., Mathurai,	A. D., Thirumangalam.
,, Subba Raja Sastri,	A. D., Ramachandrapuram,	A. D., Razole.
,, Seshagiri Rao,	Asst. in Fruits, F. R. S., Kodur,	Marketing Asst., Kakinada.
,, Venkata Rao, A.	,,	A. D., Sulurpet.
,, Venkaiah, N.	A. D., Razole,	A. D., Ramachandrapuram.
,, Vasudeva Rao, S.	A. D., Vellore,	A. D., Salur.
,, Vaidyanathan, R.	A. D., Tenkasi,	A. D., Karur.
,, Vaidyanathan, R.	Asst. in Botany, Coimbatore,	F. M., A. R. S., Palur.

Agricultural College and Research Institute, Coimbatore.

LIST OF ADDITIONS TO LIBRARY FOR JULY 1949 (Books Only Listed)

1.	BISWAS (H):	German primer for Science Students	1948
2.	BLACK (J. D.): and	KIEFFER (M. E.): Future food and Agricultural Policy Edn. I	1948
3.	CLARK (G. R.):	Study of the soil in the field. Edn 3.	1941
4.	COMSTOCK (J. H.):	Introduction to Entomology 9th revised Edn.	1948
5.	GHOSE (B. C.):	Study of the Indian money market	1943
6.	GNADINGER (C. B.):	Pyrethrum flowers Edn 2. 1945	1945
7.	GOHAR (N):	Mycoses and practical Mycology	1948
8.	GRAVES (H. B.):	Mineral key	1947
9.	JATHAR (G. B.) and	BERI (S. G.): Indian economics Vol. 2. Edn. 8	1947
10.	MASEFIELD (G. B.):	Handbook of tropical agriculture	1949
11.	SOVANI (N. V):	International position of India's raw materials	1948
12.	WEBBER (H. J.): and	BATCHELOR (L. D.): Citrus Industry V. I. History, Botany and breeding.	1948
13.	U. S. D. A.	Year book 1943 to 47 (single Issue): Science in Farming	1947
14.	U. S. D. A.	Year book 1948. Grass	1948

D. B. K.

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The Madras Agricultural Journal

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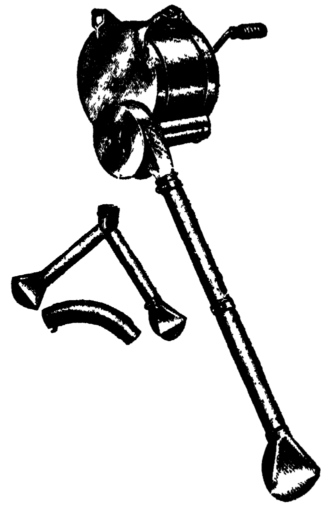
TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high — and the Editorial Board will feel obliged if your articles are brief.



The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI September 1949 No. 9

Editorial

Plantation crops : At their 52nd annual gathering the U.P.A.S.I. have pleaded for an all-round relief. The small cultivator has perhaps for the first time in his life, been able to make a clear profit. With this he has to now clear himself of long accumulated debt and rebuild his depleted stock of implements and cattle, rebuild his home and also the fertility of his soil. Certainly he has a cause to grumble, since his profits are only short lived unlike those of the other industries. He is the back bone of the country and on his welfare and prosperity lies the prosperity of the country. With the plantation crops the case is not entirely so. The industry from the beginning was built up in a manner that it depended on foreign countries for its prosperity. So long the British Empire dominated the world and empire preference and vested interests lay with India a monopoly was created. Now that Tropical Australia and South Africa have been rapidly developing these same plantation crops preference will slowly and surely veer to those countries, especially with regard to tea, jute and coffee Though an internal market has been created in India for coffee and tea it is not large enough to consume the surplus, especially, in tea. The situation has to be therefore, reviewed whether preference should not be given to such plantation crops in which India is dependent on foreign countries, crops like rubber, cloves, jute and pepper to a certain extent. Climatic and soil conditions conducive to the growth of rubber and cloves are available in South India from Travancore to Northernmost coffee belt in Mysore. Rubber has been tried and grown in these areas. It is gratifying to note that the Central Government have taken steps to develop and protect this important civil and wartime material. The planter deserves relief and encouragement in effecting its expansion, since he deals with a long-term crop and his capital gets locked up. Research work has to be encouraged in all the plantation crops and if India has to maintain her present place in the open market tomorrow, her produce will have

to be cheap and of the best quality. We earnestly hope that with concentration on quality production through research and the co-operation of labour the object will be achieved.

Sugar Price control: It is a timely and quick action that was taken and the Government of India should be congratulated, in that it did not inspite of all criticisms and excuses lose sight of the interest of the cultivator and consumers. Sugar prices even during thick of war was far lower than the normal price now. A firm action has to be taken to remedy an evil disease.

Expert Committee on Agricultural Research: On a recommendation of the Retrenchment and Reorganisation Committee, the Government of Madras have set a Committee of Experts to review the progress of research work done in the Provincial Agricultural Department during the five year period 1944—'48, in order to assess the value of the results achieved so far in terms of practical application to agriculture and to suggest further lines of work to be carried out in all branches of agricultural science. Dr. G S Cheema, D. Sc., Retired Fruit Development Adviser to the Government of India is the Chairman of the Committee, and the other members are: Dr. T. S. Venkataraman, D. Sc. former Sugarcane Specialist to the Government of India; Dr. D. V. Bal, M. Sc. Ph. D., Director, Institute of Plant Industry, Indore and Dr. Jayachand Luthra, Principal, Agricultural College, Benares Hindu University. We understand that the Committee have started work this month, and it is expected that their reports will be ready before the end of November this year. The members of the Committee are all persons with great experience and achievement in research behind them and we have no doubt, that a critical review from them with constructive proposals for the further development of Agricultural Research in the Province, would be very helpful both to the Government and research workers also. We extend our hearty welcome to the members of the Committee and wish them success in their task.

How best to translate the results of Research for the benefit of the average farmer*

By

B. M. LAKSHMIPATHY, B. E., M. E., M. R. A. S. E.
(Joint Director of Agriculture, Madras)

In all countries in the world, both advanced and less advanced, the State Agricultural Institutions and Service Organisations are the most outstanding helpers for farmers. These research and development institutions do many things for the cultivator which he cannot do himself, and this is particularly applicable to agricultural research, which pays big dividends to the rural community as a whole. Agricultural research is not a job for the cultivator and it seldom attracts private enterprise, partly because of the cost and uncertainty involved and partly because no one can monopolise the benefits. Agricultural Research is principally a job for Government institutions, Agricultural Colleges and Experiment stations. If such research is not taken up by the State, this will not be done at all.

Such new facts as are found by these researches should be made known to the farming community and others. This part of the educational and developmental work is as important as the research itself and the spread of useful information of agricultural and related subjects should also be intensively pursued by the Government agencies. In addition to the spread of such scientific information, provision should also be made for providing the necessary services and supplies at the various points from soil care to marketing and agricultural financing. The same services should also help the farmer in the development of new and wider uses of agricultural products and by-products, study human and animal nutrition, provide various living requirements, make surveys of foreign agricultural conditions, assist agriculturists in co-operative crop adjustments and help in the regulation of produce-markets. Assisting agriculturists to grow better plants and breed better animals, though the basic item, must have a counterpart in marketing help. The Department and other State agencies in addition to keeping a watch on agricultural production at home and abroad should also give facts to help the farmer to decide what to grow. The "What" is as important as the "How".

In order that the results of Research may spread among the cultivators on a popular basis, they must be of intrinsic economic value. This result could normally be achieved in two ways, either by effecting a saving in the existing methods of cultivation and other processing expenses that an agriculturist has necessarily to incur in raising a crop or it may be a means by which more yields than what would normally be obtained could be realised, by adopting certain new things. So far researches carried out by the Department have been more of a uni-purpose

*Paper read at the 32nd College Day and Conference

type and there have been very little of multi-purpose researches. For researches to be of greater utility and afford increased benefit to the cultivator, more items of the multi-purpose pattern need to be undertaken. Experimental investigations which aim at solving a combination of problems are bound to contribute in a large measure for the improvement of agriculture as such than an investigation that is expected to lead to solve only one aspect of a problem.

For research results to be readily applied on a popular basis by the cultivators, the problems should have some special relation or reference to the particular regions or areas. In other words, it means that the problems of the several districts each of which may have a peculiar bearing of its own, should be grouped and planned on a larger scale than others that may have a greater academic value and add merely to the scientific achievements. The various research branches should have combined comprehensive problems of an interrelated nature, involving team work and co-operative spirit, and these should be studied from all aspects so that the cumulative attempts of the different sectional workers may, when added together lead to quicker solutions and all-round benefits. At the moment each research section draws up its own research programme and this has led to a tendency for isolation and separatism among research workers without creating a corporate atmosphere so necessary for the advancement of scientific agriculture.

Similarly a closer and more intimate association than at present, of the officers connected with district work and the Research workers, is necessary. Even at the stage of drawing up the proprammes for research, either on a three-year or on a five-year basis, the District Officers should be consulted to have the benefit of their local experience and knowledge, to have the basic outlines drawn on a comprehensive scale. Incidentally this will increase the scientific out-look of the District Officers, and enable them to have that sustained bent for developing their regions by the application of science to agriculture. In other words, it implies that there should be greater active contacts between the research workers and the development staff in the districts to create that foundation so very essential for the extension of scientific service among the rural population.

When drawing up a list of the items of research, the demands from certain ryots or even individual representative cultivators should be given first consideration, so that as soon as a solution is reached, there will be ready ground for their immediate application. In such cases, there will be no need to persuade cultivators to take up new things, as these are what they have been waiting for anxiously. The enthusiastic ryot is already existing, and the result or results could be readily demonstrated on his field. It will spread more quickly on a popular basis than other

items for which the initial call did not originate from the cultivator himself. By adopting this procedure, cultivators themselves are brought directly on to the research and development sides of agricultural science, even at the preliminary planning levels.

Just as the different sections on the research side formulate their plans of work in advance for a few years on either a short term or a long term basis, it is necessary that the propaganda and developmental work in the several districts should also be planned in advance. The recent war has brought home to all nations that a modern State can only develop if its activities are co-ordinated on a planned basis in a common direction. Planning of agricultural development on a scientific basis is an immense task which will occupy the best human activities for many years and it must be carried out on a thorough and organised scale. In such developmental planning there must be a long term policy and a short term plan.

In the broadest sense, education brings some kind of State help and service, and functions such as commodity grading and seed certification require an educational basis. In the United States of America, the State Department of Agriculture has a number of educational agencies such as the Public Relations Office, the Extension Service, the Rural Electrification Administration and other subjects. Among the facilities offered are publications, press and radio services, motion pictures and exhibits, farmers' discussion groups, lectures, and correspondence. For example, the same State Department of Agriculture issues yearly 25,000,000 copies of farmers' bulletins, circulars, periodicals, publication lists, and other literature.

Some years ago, even of a country like the United States, it used to be said that farm practice in that land was many decades behind farm science. To-day the gap is not so wide and American agriculture has attained a high degree of efficiency. In 1943, American farms were said to produce only 47% more food than in 1918 after the first World War's peak food production. It is often mentioned that farmers in the advanced West are efficient because they strive to keep up with science and also because the Government and Departmental agencies carry agricultural science to them. Originally, the extension work in the western countries also dealt chiefly with only the agricultural prduction aspect. But now it has taken up every phase of agriculture and farm living. It is no longer confining its importance to mere production. They teach how to grow more per acre, how to get more meat and milk from their livestock for each pound of feed and also how to take care of their land. Nowadays extension work goes very much farther than furnishing mere information. It helps in arranging supplies of all kinds, in arranging for the storage of crops when the need arises, in drought relief measures, in rural relief and rehabilitation, and in numerous other ways. In many of these

activities educational and service help are rendered together on the principle that what the farmer understands will do more good to him than what he is not able to understand.

Another important extension work in the United States is the 4. H. Club These clubs — whose name stands for works with Health, Heart, Head and Hands — have members to complete certain farm and home activities under the supervision of the State agency. Their projects include all elements of farming and home making, and include community activities as well. These members have become pioneers in their communities for better farming and better living. They have helped to enlarge food and fibre production, to store and preserve food, to relieve labour shortages on farms, and assist the local committees in the various campaigns.

To-day all national Governments have accepted the responsibility for ensuring that adequate supplies of food necessary to health are available to all members of the public, at reasonable prices and it is in accordance with the recommendations of the United Nations Conference on Food and Agriculture, held at Hot-Springs in 1943 for raising the standard of nutrition of the people. Great Britain's new long term policy for agriculture echoes on the national level, that of the Food and Agriculture Organisation of the United Nations on the international level. It also aims at developing and organising food production to provide diets on a health standard for the people and at stabilising agricultural prices at levels fair to producers and consumers alike.

In England the Agricultural Research Council is the State Department responsible for the fundamental research. For the application of scientific investigations to farming practice the Agricultural Improvement Council was set up in June 1941. This same body was established on a permanent basis in July 1944. A National Agricultural Advisory Service was set up in October 1946 under the Agriculture (Miscellaneous Provisions) Act, July 1944. Advice on agricultural economics continues to be provided by staffs attached to the Universities and Colleges. The National Service includes all those concerned with advisory work to farmers at the Provincial and County centres. This arrangement is intended to facilitate general direction and guidance, securing of greater uniformity of work and co-ordination of specialist and general advisory activities. The programme of experimental work is drawn up under the guidance of the National Agricultural Improvement Council and steps are also taken to set up a series of experimental farms throughout the country.

After briefly touching upon what is known to be done in two of the leading agriculturally advanced countries of the World, the direct question as to what extent and how such scientific associations could be linked up

with our own Provincial programme, may now be taken up. The national slogan, as in other parts of the world, has to be "Full efficient production at home for as long as we can possibly foresee". While providing for stability, there must be sufficient flexibility to enable adjustments to be made to meet changing needs. Reliance has to be placed on advice and price mechanism, to steer production in the direction desired by national policy, subject to one exception — national emergency. The Government's policy both to save foreign exchange and for good farming, should be to switch our production, as rapidly as the cereals position permits, from the production of crops for direct human consumption to the production of other commodities. Local agriculture should be made not only capable of producing the regional requirements but should in addition produce such part of the food supply as may be desired in the national interest.

The position in respect of our own Province may be finally summarised as follows. The 'Grow More Food' campaign was originally started in 1943. This was enlarged on a long-term basis and expanded in a comprehensive manner early in 1947 into the 'First Five Year' programme for stepping up food production in the Province to conform to the National schemes. Recently this has been further altered into a 'Two Year' plan aiming at still greater production. One factor that clearly emerges out of these several plans is that changes and alterations have been more prominent than continuance and stabilisation of current and running items. For any substantial and progressive achievement, steadiness and sustained effort are absolutely essential, and the finally forecast results cannot be achieved at too early a stage. These however may be taken as the first stages of concerted large-scale national efforts attempting to raise the the level of agricultural production in the country as a whole. In all these national plans, large-scale aplication ot science to agriculture formed the basis for food production increases.

Just over a decade back, the question of the condition of higher agricultural education was seriously considered. It was observed that teaching, separated from research as it then existed, was not giving of its best to the students, and an amalgamation of teaching and research was effected. By this combination the students were enabled to get the latest researches taught to them by the research workers. This combination resulted in a certain amount of betterment. The present day position of agricultural development and propaganda may be taken to occupy an analogous position with the research workers not having that close mutual touch that they should have. In the same way as students were not getting their best, the ryots may, in this position, not be getting the best from scientific agriculture. It is not enough if these two agencies alone are brought together. There is a third and more important active link that has to be made to participate in a connected manner in these development programmes, and that is the owner of the land or the actual tiller of the

soil. The cultivator's willing co-operation is the most essential thing for achieving practical results, and hence close and intimate contacts between the Departmental Officers and the cultivating public on a more intensive scale than at present are essential.

A practical way of attempting to realise this is to locate the research workers and the district workers at one and the same centre, so that they may have constant mutual contacts and discussions about their several problems. The research problems for these stations, as stated already, should be drawn up with particular reference to the requirements of the concerned regions and tracts so that the solutions may immediately be taken up by the cultivators for application to their lands. By centralising the location of the district and research workers, visiting ryots to such centres will also be given an opportunity to go round the experimental station and get into touch with the scientific atmosphere which could later be incorporated in their own lands. It will at the same time afford greater opportunities to the public, to meet both the research workers and the district officers frequently at a common meeting place. The research stations that are at present tackling only experimental problems should be made to serve a dual purpose. They should be converted into combined experimental and demonstration farms. Such a change will make the farms serve the ryots and science together on a popular basis, and will also increase their utility to the public who can see clearly and understand the scientific side and the advantages of scientific agriculture applied in bulk to the land. Such a modification in the existing district and research organisations is sure to contribute to the filling up of the existing gap between the research findings and developmental plans on the one hand, and between scientific agriculture and the cultivating public on the other. By thus bringing the regional public to associate actively with the work and workers of the Department at such centres, there will be increased interest evinced in the development of agricultural science as a whole and a fuller realisation of its advantages bp the cultivators.

I would therefore suggest that in each district the research workers and the developmental officers discuss this amalgamation question and devise ways and means as to how far such a combination is feasible and how soon it could be implemented if practicable. This appears to be one of the ways be which the existing deficiencies could be remedied. It would at the same time be appropriate if in formulating the proposals for the combined working at a central place in the district, sufficient thought is bestowed to the setting up of a permanent exhibition at each place modelled on the latest lines and incorporating the principles of public relations that are now adopted on a world-wide basis in all Information Services.

How best to translate the results of Research into General Farming Practices *

By

ŚRI M. KANTI RAJ

(Headquarters Dy. Director of Agricultuie, Propaganda)

Introduction : The Department of Agriculture in this Province, was reorganised and constituted as a separate entity in 1905, about 44 years ago. During the early stages extending over a period of about 15 years, the activities of the department were mostly confined to planning and organizing (a) Research Sections at Coimbatore (b) Research-cum-Demonstration Farms in different parts of the country selected on a regional and cropbasis and (c) training the required personnel. This step can be justified because the Department can be of no help to the cultivator unless research is conducted and some tangible results are achieved for passing them on to the cultivators.

The Department expected that the agricultural practices adopted on the Research-cum-Demonstration Farms would be copied by the cultivators who visited them. This was no doubt achieved but only to a limited extent. The officers in charge of these farms, toured in the neighbourhood to study the local agricultural practices and gather material to form the basis for research work. In the course of their tours, they influenced the rich land-lords to take up certain improvements and therefore, they should be considered as pioneers in the spread of the results of research.

From the early twenties to the early forties, over a period of twenty years, though some sort of extension work was undertaken, the strengh of staff employed was very inadequate, with the result that the jurisdiction was very wide. Consequently the nature of work done was not intensive, and even the existence of the Department was not widely known. It was only in 1941, that an agriculture demonstrator was appointed for each taluk and a separate officer for each district. The step taken to bridge the gulf between research and propaganda, though belated, is not even a decade old. This fact has to be borne in mind in evaluating the work done by the Agricultural Department.

Methods Employed : The expectation of the Department that ryots after visiting the Research-cum-Demonstration farms would naturally copy the practices adopted, proved to be rather slow in influencing the cultivators. The main objection was the ingrained suspicion of the cultivator that the methods adopted to secure superior yields were not applicable to his means and conditions.

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* Paper read at the 32nd College Day and Conference.

The Department had therefore to think of some other method of influencing the cultivator. In the early twenties after the appointment of a special staff for extension work, the "demonstration farm" method was replaced by "demonstration plot" method. In accordance with the revised policy, the improvements were demonstrated on the cultivator's own land and he did all the operations under the Departmental control or direction. This change was found to be very effective. This type of ocular demonstration appealed to the cultivators very much. The improvements demonstrated were taken up eagerly and their natural spread was very wide. Even today this ocular demonstration method holds the pride of place among the various methods adopted for transmission of the results of research.

The other methods followed with varying amount of success are – staging dramas, composing ballads, issuing leaflets in non-technical language, exhibiting word and pictorial type of posters, displaying exhibits in places where the public gather in large numbers (e.g., Taluk Office, Sub-Registrar's Office, Munsiff's Court) staging exhibitions in connection with local fairs and festivals, delivering lectures, imparting education to sons of farmers by running special schools and also special classes, making use of lantern slides, issuing journals in regional languages, arranging talks through the Radio and contributing articles to the press. Each of these methods has contributed to the spread of the results of research, but I feel none of these can be compared with the part played by the ocular demonstration plot. To those cultivators who willingly co-operated with the Department and enthusiastically acted as non-official propagandists in influencing other cultivators, our departmental thanks are due.

Programme: The statement "Flag followed trade" which history has proved as correct in the case of some nations is familiar to us. On the same analogy, it can be stated "Improved methods followed improved seed" in the case of agricultural devolopment of our Province. Even today the easiest method of winning the confidence of the conservative calculative cultivator seems to be the introduction of improved seed, as the first step of approach and this will have to be continued.

Since 1937, we have had three distinguished foreign experts visiting India, at the invitation of the Central Government to study the present organisation of Agricultural Departments in India and suggest improvements. I refer to Sir. John Russel, Dr. Norman Dodd and Lord Boyd Orr. One common suggestion made by them refers to expansion of the extension side of the Departmental activity. They laid considerable emphasis on this suggestion.

Considering the jurisdiction of a taluk which on an avarage contains anything over 150 villages, scattered over 400 sq. miles even the present staff of one Demonstrator assisted by 2 or 3 fieldmen supervising and guiding the work of 3 or 4 maistries cannot be considered adequate. If the propaganda has to be effective, the cultivator has to be met constantly and guided in his day to day practices. This could be possible only if the jurisdiction of the staff is small. I feel, therefore, there is a strong case for increasing the existing staff employed on extension work. In a country like ours, where illiteracy is widespread, I feel the potential weapon for influencing the cultivator lies not through the spoken world or printed matter but through practical, ocular demonstration plot and visual education with the aid of cinema. Propaganda through cinema, has to be developed. There can, however, be no finality in the methods to be employed but past experience has confirmed that all other forms can only supplement but not supplant the ocular demonstration and visual education.

Utilization of Fruits and Vegetables *

By

Dr. G. S. SIDDAPPA

(Biochemist, Fruit Research Station, Kodur)

Modern researches have shown that fruits and vegetables are essential foods and contain highly protective factors such as vitamins and minerals which are indispensable for a proper diet. They are, however. seasonal and are not, therefore, available in plenty, throughout the year. During short periods of glut they are available in plenty, but at other times, they are scarce and beyond the reach of the average consumer. During these glut periods large quantities of these valuable foodstuffs often go to waste for lack of proper storage and transport and also preservation facilities. This is almost a criminal waste of Nature's bounty and a very important source of food. All the world over the importance of the fruit and vegetable preservation industry in the agricultural economy of the country has been fully realised. The industry is eminently suited for small scale or large scale working. In several of the advanced countries of the world there are many large fruit and vegetable canning factories. In addition to these, during the peak of the fruit season countless homes will be busy with the preparation of canned and bottled fruits, jams, jellies and marmalades. These little

* Paper presented for the 32nd College Day and Conference.

efforts on the part of the citizens go a long way in conserving the nation's food resources. In India, however only a small beginning has been made so for and that too only recently. It is, therefore, of the greatest importance that vigorious efforts should be made to rapidly develop fruit and vegetable preservation in this Province.

The Province of Madras is rich in horticultural resources. It is famous for its mangoes, bananas, oranges, and pineapples. We have also fairly large quantities of other important fruits, tropical as well temperate, such as papayas, guavas. jack fruit. etc. Very little effort has so far been made to preserve these on any large scale. The experiments conducted during the past six years at the Goverment Fruit Products Research Laboratory, Kodur, have shown that some of these important fruits can be preserved satisfactorily in several ways. Some of the products like citrus squashes, mango and pineapple jams, candied fruit and peel, etc., have been favourably received by the public. It is possible to work a small fruit preservation factory by a group of orchardists in different fruit growing localities as is being done in various other parts of the world, where fruit and vegetable preservation has come to stay as a stabilising force in the agricultural economy of the State.

By means of intensive propaganda and demonstration at their very doors and by providing all the necessary equipment at cheap rates, fruit preservation can be made popular throughout the country. To achieve this a small beginning has already been made by employing five trained lady fruit preservation demonstrators. These will demonstrate the preparation and preservation of simple products like fruit squashes, cordials, jams, jellies, marmalades, candied fruit, canned fruit dried fruits and vegetables etc., in girls' schools and colleges, ladies clubs and institutes, public fairs and exhibitions. In course of time, the idea is likely to catch on and create public interest in this vital subject which is indespensable for maintaining a balanced diet and also to improve gradually the standards of living.

The task, being of a pioneer nature, is naturally an uphill one. The results may be slow, but will be definite. Enormous quantities of valuable food that might otherwise go to waste would be saved for the Nation by thousands of small homes all over the country. To prevent waste in any form is as important as making two blades of grass grow where only one grew before.

The work at the Fruit Products Research Laboratory is so planned that it should one day result in fruit and vegetable preservation becoming a home routine in countless homes all over the country. The other aspect of making it a large-scale industry has also been not lost sight of. No effort is being spared in speeding up this work although the obstacles to be overcome are quite formidable.

Although a number of varieties of mangoes are grown in the Province, only Baneshan and Neelum have so far been found suitable for canning. Fortunately, these are commercial varieties and are therefore, suitable for canning on a large scale. The juicy 'Rasam' varieties can be made into mango squash. Mango jam can be prepared from many of the varieties. Pineapples, guavas, grape-fruit, plums, etc., can also be canned. Jack fruit, musk-melon and palm kernel are also suited for canning.

Jams, jellies and marmalades can be prepared easily from many of our fruits. Fruit juices, squashes and cordials, which are delicious and healthy drinks, and are in great demand in any tropical country, can be prepared by simple methods. Little known fruits like woodapple, cashew apple, custard apple etc., have been transformed into excellent products. Home-drying and dehydration of fruits and vegetables by modern scientific methods is fairly simple. Luxury articles like candied and crystallised fruits, candied citrus peels etc., can be prepared at home. Thus there are several ways in which fruits and vegetables can be prepared and preserved. To popularise fruit preservation in the country, a number of steps have been taken. A short course of three months training in fruit canning and preservation has been started at the Government Fruit Products Research Laboratory, Kodur. A number of simple and helpful articles have been published regarding fruit preservation. Radio talks have been given. Fruit products are exhibited in different Exhibitions and actual demonstration of preservation arranged. Five lady fruit preservation demonstrators have recently been employed to popularise fruit preservation the Province. Simultaneously there is a vigilant inspection staff also to see that fruit products sold by manufacturers to the public keep upto certain well-defined standards of quality. It is felt that when the work is in full swing, the laboratory achievements will gradually become practical achievements also.

Rice Culture in Other Countries and its Lesson for Madras*

By

M. B. V. NARASINGA RAO
(Paddy Specialist)

It may appear presumptuous for me to attempt to deal with rice cultivation in foreign countries about which I have no personal knowledge but I may be allowed this indulgence as it may be of interest to some of us here who have no access to libraries. I may at once begin to deal

*Paper read at the 32nd College Day and Conference.

with the culture in other lands with high acre yields of rice, bringing out the salient features which distinguish rice culture there and here without devoting any more time, on personal excuses.

It is officially recorded that the highest acre yield is obtained in Spain with an average of 5100 lb. of paddy. The area of rice in that country is 1·2 lakhs of acres, more or less equivalent to that under the Periyar basin in Tirunelveli District. The cultivation is carried on along lines similar to any of the countries in South-East Asia and it is grown mostly from May to October. But the points which distinguish the Spanish culture from other parts is (1)—A thorough cold weather cultivation. Fields are watered in January, harrowed under puddle, when dry, again harrowed, then ploughed again with mould-board ploughs when in condition. Later it is puddled under water in May before planting. (2)—The use of considerable quantities of suitable nitrogenous and phosphatic manures - 240 lb. Ammonium sulphate, 300 lb. of super phosphate and 100 lb. of Potassium sulphate in addition to green manures which are grown without exception on all the areas. (3)—A very liberal but graduated use of water when necessary. No machinery is used, unlike as in the U. S. A.

In Italy which has 4 lakhs of acres under rice, the yield is 3600 lb. of paddy. Here rice is a rotation crop with other cereals and legumes. The area is laid on level fields 20 to 30 acres in extent, so that tractors are used for dry ploughing. Puddling is again done by tractors drawn by horses. Though most of the area is broadcast or drilled, the Italians have fully understood the beneficial effects of transplanting and are trying to evolve a transplanting machinery due to cost of labour. Water is liberally but economically given. Very heavy dressing of farm yard manure combined with artificials are used. Artificial desiccators are developed to dry grain so as to reduce losses in storage.

Bulgaria still uses the wooden husking machine, called 'Dinki' a corrupt form of the 'Dhenki' a levered horizontal beam used in North India.

Coming to the countries in South-East Asia where the bulk of the rice is grown, Japan and China record high acre yields. Japan, called the land of Bounteous Rice Crops has an extent of 8 million acres with an average acre yield of 4000 lb. of paddy. On the whole it is a rugged mountainous land and its hillsides have been terraced and brought into service to an extent unrivalled in any part of the world except probably the 'Ingorots' of the Philippines. The whole of the Japanese culture is what may be termed 'hoe farming', ploughs and animals being scarce. The soils are inherently not very rich but are made rich every year by strenuous work; application of manures and

judicious and systematic use of irrigation water from every river and suitable reservoirs. The quantity of artificials used will stagger us — upto 100 lb. of Nitrogen 60 lb. of P_2O_5. In Japan as well as in Southern China paddy fields are kept absolutely clean. Green manures specially *Astralagus sinensis* is raised on 75 percent of the area. The use of certified seeds adds its little quota to the increased yield. Short erect varieties, not large in number, are sown to prevent wastage. Before sowing seed, all light or imperfect grains are removed by soaking in salt solution of 1·3 percent specific gravity. The yields now obtained in Japan are said to be double that of those prevailing 50 years ago and all this is brought about by practising intensive methods of manuring and irrigation and use of improved seed. The season is from June to October during which period only moderate rainfall is received, though this is uniformly distributed.

China: The outstanding feature of China rice culture is the use of fertilizers. All offal, of man and beast from city and country, is collected, stored without waste by leakage or by evaporation, allowed to ferment and decay and applied in a liquid form, to the land in small quantities so that none be lost and timed to the needs of the plant. It is applied intensively to the nurseries and the remainder to fields. Thus only this incessant and meticulous care, has made it possible for the Chinese to raise rice 'for ever'; two crops in the same year on most of the lands. The average yield here is 2,500 lb. per acre.

Java has the best developed irrigation system for rice cultivation. The soils are rich and rice is rotated usually with dry crops—maize, groundnut, or tobacco. The yield is about 2,000 lb. per acre; and here the poverty of the cultivator just as in India is a drawback for higher production. In this country an interesting industry in its relation to rice growing is fish culture. The spawn of gold fish is actually planted in rice fields and this industry provides an ideally cheap and easy source of proteins.

The cultivation of rice in the other countries Siam, the Philippines and Malaya is on very similar lines to India. The yields are poor. Much of the land in the Philippines suffers from too many weeds. There is no systamatic practice of fertilising the fields. Malaya suffers from uneven distribution of rainfall and the area is scattered in different parts of the country. Fertilising with artificials is seldom practised.

United States: The rice cultivation in this country is an example of cultivation where machinery is substituted for human labour as it is highly paid and hard to hire at any price. Hence rice is raised with the least possible use of human labour or animal labour. Almost all the rice land is ploughed up with large tractors. The usual practice is to plough, double disc and then drill the seed. Recently seed is being broadcast

in water by aeroplanes. Sowings are done in May. Lands are usually given rest to control weeds as there is no other way and this improves the fertility. Manuring with artificials is also practised on an extensive scale. Rice is cut with binders and it is found that in this practice the losses vary from 10 to 15 percent. The cut bundles are usually shocked to cure as the grain is usually cut before it is fully ripe. The shocks are then taken to the thresher commonly called separator on bundle wagons drawn by horses or by motors. The sacks from the separator are moved by 'banking-out-wagons' to warehouses and some go directly to the mills. The average yield is about 2500 lb. of grain per acre.

In recent years it is reported that rice cultivation is extending in Australia and areas which are unfiit for any crop are brought under rice with irrigation. Here also most of the cultivation is done by machinery and the cost of cultivation is reported to be very high.

It is thus seen that in many countries the acre yields are very high and sometimes there are twice ashigh as in Madras. Why is this difference ? Apart from such factors as the low standard of the actual cultivator, absentee landlordism, inadequate manuring etc, the major difference is the total climatic and ecological factors that differentiate countries like Spain, Italy and even Japan from those of India during the rice growing period. In these rice is more or less an autumn crop with adequate irrigation, favourable for greater root development and production of large amounts of dry matter. In India, most of the rice is grown in the monsoon months where not enough sunshine is available and the high percentage of humidity promotes vegetation at the expense of grain formation. Rice crops grown in the autumn months in the Madras have also given average yields of 4000 lb. over extensive areas. The cultivator in our country is in no way inferior to his compatriot in any part of the world in the job of producing crops. He is of course, illiterate, and not able to follow recent scientific developments, poor and hence not able to give adequate monetary attention to his land.

The following facts emerge from the brief outline of rice cultivation given above. These are nothing very new but their repetition may be excused because of their vital importance to the rice industry.

(1) The rice crop must be made less dependant upon the monsoon by adequate storage tanks. Areas under autumn (kar) and spring (Navarai) cultivation should be increased by more wells and tanks and cheaper power for lifting water. Rice pays for larger and assured irrigation, by (i) longer crops, (ii) more uniformly good crops, and (iii) by making two crops a year safe where only one can be grown without it.

(2) Extended use of all organic wastes; half-decayed straw and compost is found to be particularly suitable in heavy soils.

(3) Greater production and use of artificial manures with green leaf and where it is necessary, with cheap lime.

(4) An extended use of catch and cover crops of legumes. Introduction of pis-ci-culture in rice fields where feasible.

(5) Greater and closer attention to seed distribution methods. The full benefits of intensive rice cultivation are realised only with good seed improved by breeding. A central Seeds Organisation may well be worth consideration.

(6) Research for greater use industrially of waste products of rice as in Japan

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Pastures of the Kangayam tract

By

S. N. CHANDRASEKHARAN, M. A. and D. DANIEL SUNDARARAJ, B. Sc.

(Ag. Assoc. I. A. R. I.)

Introduction: Among the different breeds of cattle in India, the Kangayam breed is one of the efficient and scientifically bred animals (3). These are bred mainly in the Kangayam firka in Dharapuram Taluq of Coimbatore district and to a small extent in parts bordering on Erode and Gobi taluqs. The development of this breed has so far been carried on by enterprising well-to-do ryots, the Pattagar of Palayakottai being the foremost. The aforesaid ryots own extensive areas of well organised pastures, the Kangayam tract particularly being one with such good private pastures (2) which might be said to be responsible for the development of this famous breed of the tract.

Maintenance of Pastures: *Fencing*: The large blocks of land owned by the breeders are divided into smaller blocks by live-fencing. These fences facilitate controlled grazing by animals and form an effective protection against their straying away from one block to another, besides functioning as wind breaks. The most effective, popular and easily raised fence is *Commiphora berryii*, Engl. (Mul kiluvai) which is propagated by cuttings. With the beginning of South-West Monsoon, the existing fences are strengthened and new ones are put up. Holes are made by means of crowbars, the cuttings planted into these and are covered. The cuttings are put at least in three alternating rows which establish within a month and form a good live-fence in a short time. *Euphorbia antiquorum*, Linn. (Sathurakalli or Thirugukalli), *E. tirucalli*, Linn. (Tirukalli or Kolkalli), *Agave americana*, Linn. (Railway kathalai) *Azima tetracantha*, Lam. (Sangam mulchedi) are among some of the other fence plants arranged in the order of their respective importance.

(ii) *Cultivation of Grasses*: Great care is being taken for maintaining a good stand of *Cenchrus ciliaris*, Linn. (Kolukattai pull) in the pastures and in fact, this is the only species of grass which is actually cultivated for grazing purposes, although there are quite a large number of other grasses which grow naturally in the pastures. *Cenchrus ciliaris* forms the staple pasture and fodder grass for the Kangayam breed of cattle (1). When a field is to be brought under this grass, 2 to 4 ploughings are given with a country plough in the favourable season and the seeds are sown by broadcasting either pure or as mixtures with cholam or cumbu. 10 to 15 lbs. per acre is the seed rate adopted and the seeds are not usually covered. The seeds germinate within 5 days and in about 3 months, the grass attains a height of 2 to 3 feet with profuse tillering in average soils. Animals are let in for grazing only six months (and some times one year) after the sowing, by which time the underground rhizomes are well formed and the grass is established. Though it dries upto the bottom in the summer, being perennial and rhizomatous it revives remarkably and quickly with the rains yielding plenty of green herbage.

(iii) *Grazing*: Ten to twenty days after the monsoon rains, when there is young green flush, calves are let in for grazing as they do little harm to the growing grass. After the grass has put in good growth, the bigger animals are let in, in definite numbers and are allowed to graze for particular periods taking care to see that the pasture lands are not over-grazed. The systematized and controlled grazing practised in this tract helps to a great extent in the maintenance of pastures which are often left as permanent grazing grounds for many years.

Cultivation of legumes and trees: Besides the valuable grass, *Cenchrus ciliaris*, the important leguminous forage plant, *Phaseolus aconitifolius*, Jacq. (Naripayathan kodi) is regularly raised in the pastures year after year. Though an annual it enriches the pastures and are greatly relished by cattle both when green and dry. Very often this species along with *Phaseolus trilobus*, Ait. (Siru naripayathan kodi) the common pillipesara, comes up from the self-sown seeds of the previous year and afford a nutritious feed for the grazing animals. There are also a good number of other leguminous plants occurring naturally with the grasses.

Trees except *Acacia leucophloea*, Willd. (white babul; velvela maram) are encouraged to grow inside the pastures. Sowing of the babul seeds is usually done during South-West Monsoon and within 5 or 6 years they grow into trees giving enough shades for the resting animals, mitigating the force of the westerly strong wind and above all yielding valuable pods which are eaten by animals during the hot summer months. The pods mature in, in February–March and as they drop from the trees, the cattle feed on them. Besides, they are also collected by ryots, pounded into coarse powder and substituted for cotton seed and

bran. *Acacia leucophloea*, Willid. is perferred to *A. arabica*, Willd. (the common babul) as the pods of the latter are relished only by goats and not by cattle.. Further it comes up much better than the latter in laterite rocky soils common to this tract.

Natural Pasturage: The plants which are found in the pastures of the Kangayam tract and which form the natural feed for the cattle can be grouped as (a) pasture grasses and (b) browse plants.

(a) *Pasture grasses*: There are over forty-five grasses both annuals and perennials which grow naturally in the pastures along with predominant perennial *Cenchrus ciliaris* (Kolukattai grasses). Many of these grasses are relished by cattle and only a few like *Aristida depressa* Retz. are generally left untouched. The annuals come up with the rains of the North-East Monsoon in October–November, seed in December-January and dry up afterwards. The perennial grasses have a green flush in July–August if there are enough South-West Monsoon rains. These are usually benefitted by the North-East Monsoon rains and remain green upto January–February after which period, they are alive only under the ground and revive again with the rains of the next season.

Perennial grasses: Twenty-four species of perennial grasses were recorded in this tract. *Chrysopogon montanus*, Trin. is the second important grass (the first being *Cenchrus ciliaris*) and is followed by *Cenchrus setigerus*, Vahl. (Black kolukattai), *Cynodon dactylon*, Pers. *Cynodon dactylon*, var *intermedius* C. E. C. Fischer. (Hariali or doob grass), *Dicanthium annulatum*, Stapf. and *Chloris barbata*, Sw. *Chrysopogon montanus*, Trin. is a very drought-resistant grass coming up well in sandy and stony places. Other species like *Enteropogon monostachyos*, Schum., *Apluda aristata*, Linn., and in rocky areas *Cymbopogon caesius*, stapf., *Themeda triandra*, Forsk., *Eragrostis bifaria* Wt., are often met with. The well known grasses such as *Heteropogon contortus*, Roem & Schult. (Spear grass), *Sehima nervosum*, Stapf., (Nendra gaddi) and *Iseilema laxum*, Hack. (Chengali gaddi of Ongole tract) are rare in this tract and are found as stray clumps here and there *Chloris barbata*, Sw. (Kuruthu pul) is widely distributed in different kinds of soils. Rooting at all nodes, it is often a weed in garden land and tolerates alkalinity, though it is poor in growth under such conditions it is the only grass coming up in saline patches.

Near wet areas around Gobi and Bhavani taluqs, *Ischaemum aristatum*, Linn., *Panicum repens*, Linn., and *Eriochloa procera*, C. E. Hubb. are the dominants. *Panicum repens*, Linn. which is known as Ingi-pillu or anai arugu is a hardy plant coming up well in all kinds of soil near moist places. Because of the stoloniferous habit it tends to become a nuisance in cultivated field near channels. The cattle relish this grass and it is supposed to stimulate milk yield. *Ischaemum aristatum* and *Eriochloa procera* are mainly cut and fed to milch cows.

Annual grasses: Twenty-three annual species were recorded and most of them in areas with plenty of moisture as in wet-land cultivated tracts of Gobi and Bhavani. *Echinochloa colona*, Link., *E. crus-galli*, Beauv., *Brachiaria ramosa*, Stapf. *B. distachya*, Stapf., *Urochloa reptans*, Stapf. and *Ischaemum rugosum*, Salisb., are important among them. In garden lands and in shaded places near hedges species like *Dactyloctenium aegyptium*, Baauv., *Setaria verticellata*, Beauv., *Eleusine indica*, Gaertn., and *Digitaria marginata*, Link., occur quite frequently. *Brachiaria eruciformis*, Griseb., and *Trachys muricata*, Stend., are common annnals coming up after rains in black cotton and sandy soils respectively.

(b) *Browse plants*: The richness of the pastures of the Kangayam tract is due to the presence of a good number of plants both leguminous and non-leguminous which grow with the grasses. There are nineteen such plants which have been observed to be growing naturally in the pastures, in addition to the cultivated legume *Phaseolus aconitifolius*, Jasq., (Naripayathan kodi). This is the only legume cultivated in the pastures and is also grown as a pulse and a supplemental fodder in dry lands. *Phaseolus trilobus*, Ait. (Panipayar or Pillipesara) and *Indigofera enneaphylla*, Linn.. (Seppuneringi) are the other two important legumes followed by *Alysicarpus* and *Rhynchosia*. Among the non-legumes, amarantaceous plants as *Digera arvensis*, Forsk, *Celosia argentea*, Linn. *C. Polygonoides*, Retz. and *Allmania nodiflora* R. Br. are the common ones. The convolvulaceous *Merremia tridentata*, Hallier., *Ipomoea pes-tigridis*, Linn and are greatly relished by cattle to some extent. The other plants which are eaten by cattle are *Boerhaavia diffusa*, Linn. *Nyctaginaceae*), *Tridax procumbens* (*Compositae*) *Physalis minima*, Linn. (*Solanaceae*), *Borreria hispida*, K. Sch. (*Ruciacaeae*) and *Commelina benghalensis*, Linn. (*Commellnaceae*). In times of great fodder scarcity as in prolonged summers, the leaves of *Borassus flabellifer* (Palmyra) is fed to animals and forms an important famine fodder.

II. NOTES ON NATURAL PASTURAGE.

Perennials :

1. *Cenchrus setigerus*, Vahl. (Kolukattai grass-black) Tamil: Karuppu Kolukattai pull. Though this is not found so commonly as *C. Ciliaris* is next of importance in fodder value

2. *Chrysopogon montanus*, Trinn. Tamil: Chola pull; Telugu: Adavi soma gaddi. The second commonest grass after *Cenchrus ciliaris* in the dry tract coming up well in sandy and stony soils. It forms a good fodder grass for the animals before flowering. By March—April when the grasses dry up, the yellow thin culms devoid of the spikelets which fall off are grazed by cattle.

3. *Cynodon dactylon*, Pers. Hariali or Doub grass. Tamil: Arugampull: Telegu: Gericha gaddi, Kanarese: Kuddi garika. Perennial with deeply penetrating underground root-stocks and growing to 6 to 9 inches. It is often a very bad weed in cultivated field with heavy soil. The grass is relished by horses and sheep.

4. *C. dactylon* Pers. var *intermedius*, C. E. C. Fish, similar to the above but prefers slight moisture conditions and puts-forth better growth.

5. *Amphilophis pertusa*, Stapf. Tamil: Chinnakarai pull, Chevoarugam pull; Telegu: Genjulu. A well spreading grass coming up well in loams, but found in all soil conditions and forms an excellent green feed.

6. *Dicanthium annulatum*, Stapf. Telugu: Molava gaddi. A tufted grass found in good loams. Highly relished by cattle, but rather rare.

7. *Chloris barbata*. Sw. Tamil: Kuruttu pull; Telugu: Uppu gaddi. Widely distributed on all soils, rooting at nodes and is often a weed in garden lands. It has a virtue namely it tolerates alkalinity in soil. Cattle feed on them readily.

8. *Enteropogon monostachyos*. Schum. Tamil: Kannai pull. It grows upto 3 feet with erect and tufted stems arising from a woody root-stock. It is found scattered in some places and forms a good fodder.

9. *Iseilema laxum*, Hack. Tamil: Thenganari pul; Telugu: Erra chengali gaddi. This occurs as stray clumps with short creeping root-stock. A good fodder grass.

10. *Eremopogon foveolatus*, Stapf. Grass growing in clumps with plenty of foliage and prefers calcareous soil Fairly abundant and is one of the best fodder grasses.

11. *Apluda aristata*, Linn. Tamil: Malam pul, Manda pul. Telugu: Bura kanchi; Kanarese: Akkii Hubbu. Tall leafy grass. Coming up well on hills and near hedges, but not common Fairly good fodder.

12. *Eragrostis bifaria*, Wt. Telugu. Nakka piththu kaseru, Gubbikal Gaddi; Kanarese: Modi Mara Hullu, Nosaihullu. A Slender grass growing in dry rocky and gravelly area Cattle graze this readily.

13. *E. plumosa*, Link. Slender grass readily grazed by cattle but the quantity of forage is better and the grass is also not common.

14. *Sporobolus coromandelianus*, Kunth. Short stumpy and tufted grass common on poor soils but a poor fodder.

15. *Heteropogon contortus*, Roem and Schult. 'Spear grass' Tamil: Oosi pul: Telugu; Ooba gaddi, Pandi mullu gaddi, Kanarese: Ankari Hullu. Densely tufted grass which stands drought well and though not common. It is found on hill sides. A good fodder when young and green but not touched by cattle after flowering due to the presence of long awns. Cattle graze the grass after the awns drop off. It forms a good hay crop.

16. *Sehima nervosum*, Stapf. Telugu: Nendra gaddi; Kanarese: Nalai hullu. Though not common in the tract, it is found in stray places near hills and grows in clumps with large number of tillers. It grows to about a foot in height in this area and is highly relished by cattle If only this could be cultivated it will form one of the best fodder grasses.

17. *Themeda triandra*, Forsk. Tamil: Erigai thattu pul. Telugu: Pedda yerra kalla kasuri. An erect, tall growing, coarse grass, eaten by cattle only when young and occurring on dry hilly areas.

18. *Aristida hystrix*, Linn. f. Diffuse and branching grass, found common in the hilly dry and gravelly areas but not eaten by cattle.

19. *Aristida setacea*, Retz. Tamil: Thodappan pul. Tall and coarse grass used in making brooms. Not eaten by cattle.

20. *Ischaemum aristatum*, Linn. An erect and decumbent grass common in wet areas around Gopi and Bhavani. It is usually cut and fed to animals.

21. *Panicum repens*, L. Ginger grass. Tamil: Inji pul Anaiarugan; Telugu Lada or Karigaddi; Sonti Hullu. The grass is found in moist and wet areas in both sandy and clayey soils. It has hardy stoloniferous rhizomatous stems. The cattle relish it well; and it is said to stimulate the yield of milk.

22. *Eriochloa procera*, C. E. Hubb. Tamil: Karunganni pul. Another grass found along the irrigation channels in paddy fields in Gobi and Bhavani and readily eaten by cattle.

23. *Enneapogon elegnas*, Stapf. This is a slender erect grass growing 3-12 inches. Though fairly abundant, this is not relished by cattle.

24. *Cymbopogon caesius*, Stapf. Tamil: Vella Mungan pul. Kamatchi pul; Telugu: Kasigaddi; Kanarese: Kasi hullu. An erect grass, coarse and with a strong odour occuring on hills but not eaten by cattle.

Annuals:

25. *Dactyloctenium acgyptium*, Beauw. Tamil: Maththangi pul. It is a prostrate plant with stems rooting at the nodes. Though it comes under all conditions, it prefers loamy garden soil. Cattle eat them well.

26. *Andropogon pumilus*, Roxb. Tamil: Kaththiri pul. Fairly common in the black soils and relished by cattle before flowering.

27. *Trachys muricata*, Steud. Tamil: Karuvattu pul or Sani velam pul. Telugu: Pedda utla gaddi. This grass grows abundantly in sandy areas soon after rains and forms a very good fodder.

28. *Perotis indica*, O. Ktz. Tamil: Narival pul, Kudiraival pul; Telugu: Boosara gaddi, Nakka toka gaddi; Kanarese: Nari Meesai hullu. A small grass with a prominent and characteristic inflorescence. Grows in rocky and gravelly areas. Does not form a good fodder though animals graze on thom.

29. *Urochloa reptans*, Stapf. Tamil: Shani pul. A slender prostrate annual found on heavy, moist soils and is liked by cattle.

30. *U. setigera*, Stapf. Much bigger than the former species and greatly relished by cattle.

31. *Brachiaria eruciformus*, Griseb: Telugu: Dhoma Kalugaddi. A common grass in the black soil areas of the tract and often found near fences. The forms small tufts with slender spreading branches and is readily eaten by cattle.

32. *Brachiaria ramosa*, Stapf. Tamil: Sommai pul; Tel. Eduri gaddi; Kanarese: Kodu Baragu hullu One of the best fodder grasses growing in abundance after the rains. The stems are stout and ascending from a creeping base and are relished by cattle.

33. *B. distachya*. Stapf. Telugu: Kotanna gaddi, Kanarese: Hambu haraka hullu. A fairly common grass of the tract in loamy soils. Does not thrive in rocky areas. Forms a good fodder.

34. *Eragrostis ciliansis*, Link. Often found as a weed in dry and garden lands. Cattle relish it.

35. *Eleusine indica*, Gaeutn. A tufted grass growing in moist areas after rains. It is readily grazed by cattle.

36. *E. lagopoides*, Merr. Found in alkaline, wet places and well spreading. Cattle don't relish it.

37. *Dinebra retroflexa*, Panz. Occurs in alkaline loams. Cattle relish it before flowering.

38. *Setaria pallidifusca*, Stapf et Hubb. Tamil: Korattu pul; Telugu: Korattu pul; Telugu: Kuradakori gaddi.

39. *S. Verticellata* Beauv. Tamil: Korattu pul. Slender tufted grasses occurring in shades near fences. Cattle graze on these readily.

40. *Alloteropsis cimicina*, Stapf. Tamil: Chena pul; Telugu: Bottanpala gaddi; Kanarese: Neru sajjai hullu. Though this is not found very commonly in the tract, it was found to be in good proportions with other grasses in few pastures around Gobichettipalayam and Udumalpet and are readily grazed by cattle.

41. *Echinachloa colona*, Link. Tamil: Karumpul, Varsanam pul, Telugu: Otha gaddi.

42. *E. Crusgalli*, Beauv. Tamil: Oothu pul; Telugu: Pedda otha gaddi. These grasses grow as weeds with paddy in paddy fields and are cut and fed to animals which relish them very much.

43. *Paspalidium flavidum* A. Camus. Tamil: Arisi pul; Telugu: Uda gaddi. A very good fodder grass growing in low lying moist areas, but not common.

44. *Digitaria marginata*, Link. var *fimbriata* Stapf. Tamil: Kakkai kal pul. A decumbent grass with long flowering culms and often found as a weed in garden lands.

45. *Tragus biflorus*, Schult. Tamil: Ottupul. A low spreading grass thriving in dry sandy localities. Though common cattle do not readily eat them.

46. *Aristida depressa*, Retz. A tufted grass rarely attaining more than one foot high and common on poor soils, but cattle do not eat this.

47. *Ischaemum rugosum*, Salisb. An erect plant found along wet land bunds and in shaded areas near fences. Cattle feed on them.

Browse Plants: i. *Legumes*

48. *Phaseolus aconitifolius*, Jacq. Tamil: Naripayathan Kodi, Thulukkappayar. The only legume cultivated in the pastures for grazing and on dry lands as a pulse and a supplemental fodder. It is a long trailing plant and requires fairly good soil. Relished by cattle both when green and dried.

49. *Phaseolus trilobus*, Ait. Tamil: Passipayaru, Sirunaripayathan kodi. Telugu: Pillipesara. A variable plant found in all kinds of soils either poor or rich and encouraged to grow in the pastures. It appears year after year from self sown seeds and forms a nutritious food.

50. *Indigofera enneaphylla*, Linn. Tamil: Seppu neringi. A common and very important perennial with thick root stock and spreading habit. Enriches the pastures and is greatly relished by cattle.

51. *Rhynchosia minima*, Yc. A slender trailing or climbing plant which is encouraged to grow in the pasturers and readily grazed by cattle.

52. *R. Capitata*. A bigger plant than the former, but rare.

53. *Alysicarpus rugosus*, Dc. Tamil: Nama poondu. An erect herbaceous annua with moderate foliage and well relished by cattle.

54. *A. rugosus, Dc. var. styracifolius*, Baker. Tamil: Sirunama poondu. A smaller form of the above-mentioned species, but quite common in heavy black soils.

55. *Crotalaria globosa*, W and A. Tamil: Ponnai kattai kodi. A very common trailing annual coming up even in poor soils and forms a fairly good fodder.

ii. *Non-Legumes*.

56. *Digera arvensis*, Forsk. (Amarantaceae) This is an annual herb with prostrate branches found as a weed in cultivated lands, waste places and also in pastures. This is a greatly relished by cattle. The leaves are used as a green vegetable by poor people.

57. *Celosia argentia*, Linn. (Amarantaceae) Tamil: Ponnai kerai A very common plant which grows to 3 to 5 feet, often allowed to grow with cholam with which it is harvested and stacked. After 2 or 3 months, both are shaffed together and fed to animals which relish them. Cattle also brouse on the leaves and tender portions of the plant.

58. *C. polygonoides*, Retz. Tamil: Ehkattu keerai. Another common amarantaceous plant similar to *Digera arvensis* but found in dry and poor soils and readily broused by cattle.

59. *Allmania nodiflora*, R. Br. (Amarantaceae) This is a perennial with stout roots stock. The herbaceous branches are relished by cattle.

60. *Aerva tomentosa*, Forsk (Amarantaceae) It is a white tomentose plant common on road sides, rocky and gravelly areas and in cultivated field. It is eaten only by goats.

61. *Boerhaavia diffusa*, Linn. (Nyctaginaceae) A common weed in dry localitie- and on field bunds with stout root-stock and many procumbent branches which are eaten by cattle.

62. *Merremia tridentata*, Halliei f. (Convolvulaceae) Tamil: Savuli kodi. A perennial herb with long slender prostrate branches greatly relished by cattle.

63. *Ipomoea pes-tigridis*, Linn. A hairy climber readily broused by animals

64 *Tridax procumbens*. Tamil: Orambuppondu. A common compositae found in all kinds of soils and greatly relished by buffaloes. When fresh and green after rains, cattle also feed on them.

65. *Physalis minima*, Linn (Solanaceae) Tamil: Natuthakalli. Telugu: Budama aakku A succulent herb growing after rains and easily made out by the inflated accrescent calyx. Cattle eat these readily.

66. *Borreria hispida*, K. Sch. (Rubiaceae) Tamil: Naththa choori Telugu: Mathana aakku. A herb with long procumbent branches and broused by cattle

67. *Commelina benghalensis*, Linn (Commelinaceae) Tamil: Valukkai poondi. A slender herb with creeping stem which root at lower nodes. Common on red loams and greatly relished by cattle.

References:

(1) Jacob, K. Cherian (1944)—Breeds of cattle and their staple fodder grasses Madras Agricultural Journal Vol. 32: p. 152.

(2) Anonymous (1939) A village enquiry regarding cattle Indian Cotton Agricultural Research, Misc. Bull. No. 22. p. 98.

(3) Anonymous (1941) A brief survey of some of the important breeds of cattle in India, ibid No. 46, Part III p. 13.

Extracts.

Adoption of measures for the improvement of cotton yield in Madras (From The Director of Agriculture)

The following article entitled "World cotton production record is claimed by S. C." by A. B. Bryan, former Agricultural Editor, S C. Extension Service, U. S. A., which appeared in a recent issue of "The Cotton Trade Journal" is for information:—

"**World Cotton Production Record is Claimed by S. C.**" Chester County Farmer gets 3·3 bales per acre in 1946. (By A. B. Bryan, former Agricultural Editor, South Carolina Extension Service)

(In the April 30 issue of THE COTTON TRADE JOURNAL, Victor Schoffelmayer, widely known cotton and chemurgic expert, described a cotton-growing contest, in Texas in 1925 when G Mont Adams, Amith County farmer, produced 1,612 pounds of lint per acre. To his knowledge, Mr. Schoffelmayer observed, this record has never been surpassed.

No So, says H. G. Boylston, cotton improvement specialist of Clemson; S. C. Mr. Boylston forwarded us the following story about J. Harvey Neeley, Chester County, S. C. farmer, who in 1946 grew 1,655 pounds of lint per acre to take first prize in that state's annual 5—acre contest).

The South Carolina Five-Acre Cotton Contest, which has been a powerful factor for twenty years in increasing per acre yields and improving the length and quality of lint, reached in 1946 its highest pinnacle in production per acre and in percentage of lint one inch or more in staple length

The winner of the first state prize, J. Harvey Neeley, made on five acres 8275 pounds of lint, or 3·3 bales per acre; the eight state and district prize winners average 1,122 pounds of lint per acre; and the 628 contestants averaged 602 pounds of lint per acre.

In the matter of staple length, improvement has been so noteworthy that in 1946. 100 per cent of all cotton produced in the state was 15/16 inch or longer, and 98·2 per cent was one inch or longer.

Harvey Neeley's Feat: Intensely proud but entirely free from vainglory is John Harvey Neeley, Chester county, who broke the all time cotton production record in South Carolina with his 8,275 pounds of 1-1/8 inch lint and won state prize of $ 750.

Neeley's average yield of 1,655 pounds of lint per acre is probably the record also for the entire South's Cotton Kingdom Certainly it is a feat for this youngish farmer with only a few years of experience in farming independently since his father's death three years ago.

Neeley's contest cotton was grown on well drained field of Iridel (black jack) soil; which had been planted to cotton yearly some 20 years, with liberal quantities of stable manure each year from the nearby stables, with, of course, plenty of commercial fertiliser intelligently applied by Harvey's late father.

Secret of Success: Harvey Neeley's "secret" of success with his cotton production is really no secret. He sets it down thus: (1) the best variety available—he used Coker 100 Wilt Resistant strain 8: (2) lots of plants per acre—hills 12 inches apart on rows on 32 inches wide; (3) liberal liming and fertilizing with insistence on potash in plenty; and (4) "garden-like" attention in cultivation—"not harm a stalk". "But", he insisted, "I never could have done it without the Lord's help in providing a fine growing season".

Just a word more on Harvey Neeley's methods of production. The Iridel loam soil had 400 pounds of ground limestone each year for five years. It had abundant organic matter because of the annual applications of stable manure.

5 Per Cent Ceresan: In immediate preparation, cotton stalks were ripped out the land was fertilized with 1,200 pounds of 4—8—8 per acre, broadcast, dragged and ridged in late March The seed, planted April 11—13, was treated with 5 per cent Ceresan. On June 3 a top-dressing of 100 pounds per acre of muriate of potash; 100 lbs, nitrate and on June 17 to a top-dressing of 100 pounds per acre of 32·5 per cent ammonium nitrate and 100 lbs. muriate of potash".

2. This crop was grown as a part of a prize competition, in which the cost of cultivation was perhaps of no consideration. The cotton was grown on 5 acres of well-drained black soil which had been planted to cotton yearly for some 20 years with liberal quantities of stable manure each year and plenty of commercial fertilizer. Prior to the year in which this record yield was harvested, the land had received 400 lbs. of ground limestone per acre for five years. In the year under report, the land was fertilised in late March with 1,200 pounds per acre of 4—8—8 manure mixture, containing nitrogen, phosphoric acid and potash in this ratio and the seed, after treatment with the fungicide-ceresan, was sown in the second week of April. In addition, the following manures were also applied :—

Date	Manure	Quantity applied per acre
3rd June	Muriate of Potash (contains 46—58% of Potash) ...	100 lbs.
	Nitrate (Probably Nitrate of Ammonia) ...	100 lbs.
17th June	Ammonium Nitrate (32—5% N) ...	100 lbs.
	Muriate of Potash ...	100 lbs.

3. It will be seen that the crop not only benefitted from the residual effects of manure applied in previous years, but it also received the undermentioned quantities of Nitrogen, Phosphoric acid and Potash in its life time:—

$$\left.\begin{array}{lll} N & \ldots & 113 \text{ lbs.} \\ P_2O_5 & . & 96 \text{ lbs.} \\ K_2O & \ldots & 200 \text{ lbs.} \end{array}\right\} \text{per acre.}$$

With this treatment this 5 acre crop gave an average yield of 1,655 lbs. of lint per acre (—4·2 bales of 400 lbs.)

4. It is perhaps desirable to conduct similar competitions among cultivators in the different tracts of this country. If the cotton Committee approves of the idea, the provinces and states will be invited to submit schemes for such contests indicating the required aid from the Committee.

A Short Note on the Manuring of Cotton at the Agricultural Research Station, Koilpatti: Manurial experiments were conducted on this station from 1903 onwards to guage the increase in yield that could be obtained by applying various manures like cattle manure, cakes and chemical fertilizers. Results showed that both cotton and cereals respond to the application of nitrogen in any form. Trials with Farm Yard Manure collected by the various systems viz., loose-box, byre and heap were done on crops—cotton, cumbu and irungu from 1903 and continued every year till 1912. The

response to the application of 10 cartloads of manure was increase in yield in cotton by 50 to 75%. Neem cake at 1,000 lbs. per acre i. e., 50 lbs. of nitrogen increased the yield of cotton by 50%. Residual effect was noticed on the succeeding crops also. Results of trials with Ammonium Sulphate at 20 lbs. per acre during 1921—22 revealed that cotton yields could be increased by 13%. Systematic trials with Ammonium Sulphate and Groundnut Cake were conducted during the years 1929 to 1935 on cotton and cereals. Two cwts. of ammonium sulphate applied direct to cotton increased the yield by 40% while 500 lbs. of groundnut cake increased the yield by 35%. Residual effect was invariably recorded in the subsequent cereals—cumbu or irungu.

2. Manurial experiments with groundnut cake and ammonium sulphate in various doses were conducted on cotton during the years 1943—44 to 1945—46 as recommended by the Indian Central Cotton Committee. Cotton responded to manuring in six trials out of seven. With increase in dose of manure increased yields were obtained. The yield results and the economics of manuring are presented in table I attached. By applying 100 lbs. N. per acre the yields could be increased by cent per cent. Doses higher than 40 lbs. nitrogen left a residual effect which resulted in significantly higher yields in the succeeding cereal crop. It can be seen from the table that the ryot will get an additional income of Rs 60 - to 92 by applying nitrogenous manures at the rate of 80 lbs. Nitrogen and Rs. 114 to 147 by applying a dose of 100 lbs. Nitrogen per acre. By applying manures direct to cotton, the ryot not only benefits himself but also helps in increasing the production of cotton and the food crop. It has been found that the ryots get more income by applying manure direct to cotton than by applying to cereals. The economics of applying manure direct to cotton and direct to cereals is worked out and presented in table II.

3. The response of cotton to direct manuring is not unknown to the ryot. Well-to-do ryots manure their cotton crop by sheep-penning. It is only the non-availability of manure which prevents them from manuring their cotton crops They apply all the cattle manure to the food crop, and so cotton crop is left without any manure If sufficient manure is made available to the ryot, he can be persuaded to manure his cotton crop as well. Since the effect of manuring is spectacular, only initial propaganda is necessary to make him apply fertilizers to cotton.

4. Competitions in the cultivation of cotton by the institution of prize for the best crop in each taluk would be an incentive for the ryots to pay greater attention to cultivation. It would also enable the Department to know the highest acre yield that would be possible in the different cotton tracts.

TABLE I

Treatments	Mean yield per acre in lbs. Cotton kapas	Residual effect 2nd year. Cumbu grain.	Residual effect 2nd year. Irungu straw.	Extra yield over 'No manure' in lbs. Direct on cotton residual effect on cereals: Cotton kapas 1st yr.	Value @ 0-6-6 per lb.	Cumbu grain 2nd yr.	Value @ 8 lbs per Re.	Irungu straw 2nd yr.	Value at 80 lbs per Re.	Value of manures and appli-cation	Net profit due to manuring, Cotton 1st year + cumbu 2nd year	Net profit due to manuring, Cotton 1st year + irungu 2nd year	Remarks
					Rs. A. P.		Rs. A. P.		Rs. A P.	Rs .A .P.	Rs. A. P.	Rs. A. P.	
Manure	492	341	4461										
Amonium sulphate to supply 20 lbs. nitrogen.	625	352	4461	133	54—1—0	11	1—6—0	459	5-12—0	18-15—0	36—8—0	40-14—0	Average of 3 years seven trials on cotton.
Do. 40 lbs.	676	377	4898	184	68—8—0	37	4-10—0	897	11—3—0	36—2-0	37—0—0	43—9—0	
Do. 60 lbs.	711	543	5450	219	89—0—0	112	14—0—0	1949	18—2—0	53—5-0	49-11—0	53-13—0	
Do. 80 lbs.	834	574	6664	321	130—7—0	206	25-12—0	2652	33—2—0	70-12—0	85—7—0	92-13—0	Average of 2 years
Do. 100 lbs.	1055	604	8976	410	166—9—0	318	39-12—0	4623	57-13—0	87-15—0	118—6—0	136—7—0	Average of 1 year.
Groundnut cake to supply 20 lbs of nitrogen	602	359	4546	110	44-11—0	48	3—8—0	844	10—9—0	18-10—0	29—9—0	36-10—0	Average of 3 years.
Do. 40 lbs.	672	379	4702	180	73—2—0	39	4-14—0	701	8-10—0	35—4—0	42-12—0	46-10—0	
Do, 60 lbs,	713	445	5247	221	89-13—0	104	13—0—0	1245	15—9—0	51-14—0	50-15—0	53—8—0	
Do. 80 lbs.	778	554	6367	265	107-11—0	186	23—4—0	2355	29—7—0	69—0—0	61-15—0	98—2—0	Average of 2 years
Do. 100 lbs,	1108	48	8922	463	175-10—0	195	24—6—0	4569	57-12—0	85-10—0	114—6—0	147-12—0	

Value of Manure: Amonium Sulphate 0—2—9 per lb.
Groundnut cake 0—1—0 ,,

Includes cost of powdering of cake, application and and covering with Junior hoe.

TABLE II

Direct Manuring to Cumbu and residual effect on cotton
Average yield for three years (1929—31)

Treatments	Mean yield of cumbu 1st year	Extra yield of cumbu over control	Value of extra yield of cumbu at 8 lbs per Re. 2nd year	Yield of Cotton in the next year.	Extra yield over control.	Value of extra yield of cotton 6½ as. per lb.	Cost of manure and application	Net profit of cumbu 1st year + cotton 2nd year	Remarks
1	2	3	4	5	6	7	8	9	10
	lbs.	lbs.	Rs. A. P.	lbs.	lbs	Rs. A. P.	Rs. A. P.	Rs. A. P.	
C. No manure	313			548					
A. Amm. Sulphate 2 cwts + Super 1 "	749	436	54—0—0	595	47	19—2—0	54—8—8	19—2—0	
B. Gr. Cake 500 lbs. + Super 1 cwt.	636	323	40—6—0	616	68	27-10—0	42—4—0	25-12—0	

Direct manuring to cotton and residual effect on cumbu
Average yield for three years (1929—31)

Price : Kapas 6½ as per lbs. cumbu 8 lbs per Re.

1	2	3	4	5	6	7	8	9	10
			Rs. A. P.			Rs. A. P.	Rs. A. P.	Rs. A. P.	
C. No Manure	420			319					
A. Amm. Sulphate 2 cwts. + Super 1 cwt.	601	18	73—8—6	411	92	11—8—0	54—8—0	30—7—0	Amm. Sulphate: 0-2-9 per lbs.
C. Groundnut cake 520 lbs. + Super 1 cwt.	584	164	66-10—0	475	106	13—4—0	42—4—0	37-10—0	Super phosphate 0-2-0 per lbs.

Gleanings

Better Groundnuts Expected in Australia: It is hoped to develop groundnuts strains with a higher resistance to disease by crossing Australian varieties with vigorous plants obtained by the CSIRO from South America It is also hoped that the hybrids produced will give a higher yield than the varieties now generally grown. Groundnut industry is well established in Queensland, and some success has also been achieved in northern parts of New South Wales. In the 1947-48 season the acreage in New South Wales increased to 67 compared with a mere 17 acres in the previous year and the yield was nearly 92,000 lb.

There seems, however little chance of establishing the crop in the cooler southern parts of the State. Trial crops have been grown for three years at the Yanco Experiment Farm, on the Murrumbidgee Irrigation Area, but the climate and heavy soils have proved unsuitable, and further trials in this area are considered useless. Variety trials will be continued at the Grafton Experiment Farm, on the North Coast, and in the Dumaresq River district, where irrigation is available.

Rice Crop should be a good one: Reports from the Murrumbidgee Irrigation Area, in New South Wales, indicate that the rice crop should be good this season, but not equal to the results obtained last year. In the older Griffith area, harvesting conditions have been made difficult by untimely rains. Australian rice industry is highly mechanised. and on the soils used for rice growing. wet weather creates many problems. Some growers found their machines bogged in the mud, and others had to use two tractors to pull the headers through the crop. Rice growing on the new Wakool area has begun fairly well. The crop has averaged about 1½ tons to the acre from 6,000 acres, yielding a crop worth about £A 180,000.

Australian rice yield about 50,000 tons this year: The Australian rice crop harvested from the 33,000 acres sown during the 1948—49 season will yield about 50,000 tons. The harvest is pleasing, since up to March, 1949, forecasts were very gloomy and it seemed that the first rice failure recorded in Australia might be imminent.

Cool conditions and weed infestation checked the crops originally but the grain now being harvested is excellent. Heads are somewhat smaller than last year and the average yield will consequently be lower than in 1947—48 but should reach between 32 and 35 cwt. an acre. Several of the best crops already harvested have reached two tons and over to the acre. Except for a small quantity reserved for invalids and for visiting and residential Asians in Australia, the entire crop will be exported to Eastern countries.

Important Agricultural Conference in Australia: Twenty or more scientific specialists from India, the United Kingdom, Canada, South Africa and New Zealand, together with several observers from the United States will attend the British Commonwealth Scientific Conference on agriculture to be held in Australia this month. This is the first of a series of specialist conferences recommended by the 1946 Official Scientifiic Conference held in London. Theme of the conference will be 'Plant and Animal Nutrition in Relation to Soil and Climatic Factors'. Leader of the overseas delegations will be Sir Edward Salisbury, Director of the Royal Botanic Garden (England); Professor E. W. Crampton, Department of Nutrition, McGill University (Canada); Dr. T. G. Mirchandani, Division of Agronomy, Agricultural Research Institute (India); Dr. E. J. Filmer, Animal Research Division, Department of Agriculture (New Zealand); Mr. J. C. Bonsma, Senior Animal Nutrition Research Officer, Department of Agriculture, (South Africa) Dr. I. Clunies Ross, Chairman of the Commonwealth Scientific and Industrial Research organisation will head the Australian delegates. Observers will include Professor W. Albrecht of the University of Missouri; Dr. Bonner, of the California Institute of Technology; and Dr. K Hammer and Professor P. R. Stout, both of the University of California.

Conference will begin with a series of meetings in Adelaide, South Australia from August 22 to 31, followed by a 12-day tour of southern South Australia, Victoria and southern New South Wales to show delegates something of Australian research and agricultural practice. The final sessions will be held in Canberra, Australia's national capital, from September 13 to 15, 1949.

Mowing Checks Orchard Soil Erosion: An interesttng experiment in the control of soil erosion in a citrus grove has been in progress for three years at Kurrajong Heights, New South Wales, and the results have been particularly successful. The citrus grove was on steeply sloping land, and there was a continual loss of soil from water erosion. The owner of the property consulted the Department of Agriculture, and was advised to try controlling weed growth by mowing instead of cultivation. A small motor-operated mower was used whenever the weeds grew high enough to cut. Mown weeds were left on the ground. They provided a useful mulch in dry weather and decayed in the wet season to keep the soil in excellent physical condition. This practice preserved the mat of roots in the topsoil. Soil loss by erosion has been completely checked, even during periods of heavy rain. Only cultivation the orchard now receives is superfcial treatment with a rotary hoe to a depth of 1½ inches, once a year when the main application of fertilizer is given. Improvement in the grove has been striking, and three other orchardists in the district have adopted the same methods.

Letters to the Editor

Further Experiences of an Educational Officer in Farming: Our Fruit Specialist was pleased to send for publication, extracts from the report I had sent him at his request. This was published under the title "Experiences of an Educational Officer in Fruit Farming" in Vol No. XXXIV October 1947 of the Madras Agricultural Journal. This report has probably given readers an incorrect impression of this farm. That would not have mattered but for the fact that the article resulted in some letters to me from some farmers. With the repeated Editorial requests for brevity in mind, I shall be as brief as possible even at the risk of obscurity.

I planned a plan which differed from all the innumerable plans which made up the spate of plans for post-war and post-independence reconstruction experienced in recent years. While all the latter were made for the Government or someone else—chiefly Government, to carry out, mine had the unique feature that it was intended for me to work on, and it was not a Five year plan. I do not believe there is any magic in the figure Five. My favourite figure is three. In any case at my age, three years is a period long enough to look forward to. At the completion of my first three-year plan, I sent the above-mentioned report to the Fruit Specialist. Now, I have completed my second 3-year plan and commenced my third.

The two possible misconceptions are:— (1) That this farm is only an orchard. (2) That I am practising some combination of Hydroponics and soil-less culture compounding weird chemical mixtures, and juggling with pHs and other strange combinations of the alphabet.

I have my fair share of vanity (some would go further than that). In my vanity, I aimed at making this a "Pilot Farm" to demonstrate what scientific farming means. At the very outset I had to find the answers to two questions—what type of farming? What system of farming within the type? The answer to the first was obvious and that was "mixed Farming". The answer to the second was more difficult. It took me two three-year periods to find the answer My third three-year plan is devoted to putting into practice, on an ever-increasing scale, the system evolved.

My system is "Mixed Diversified Farming" calculated to yield a profit and at the same time to build up the fertility of the soil We have now an orchard, live stock (also "mixed" consisting of cattle including two stud-bulls presented by Sri G. V. Narayana, now Oil Seeds Specialist, goats, fowls and ducks), paddy, pulses, root crops and fodder i. e., grasses as well as deep-rooted and perennial and seasonal legume substitutes for lucerne.

Being a science graduate my idea of scientific farming was that of the Rothamsted School. All one has to do, I thought, was to use as manures various chemicals out of chemical factories. At the start there was a lot of them available which nobody wanted. Also groundnut cake of which I was buying some three tons annually for manure and cattle feed. Soon, fortunately very soon, I awakened to the fact that, instead of adopting practices which any ryot could copy, I had drifted into what few could imitate. At the same time, the shortage of supplies began to develop. I foresaw "controls" would soon come in, which would effectively cut off all supplies. Even otherwise, I had strayed so far from my goal that I got alarmed lest I lose my bearings altogether.

About this time began a lot of talk and planning about starting ammonium sulphate factories by the Government of India. This brought forth a solemn warning against the use of Ammonium sulphate from Sir Albert Howard. I had never heard of him, yet I was intrigued. He must be somebody important for such a heterodox pronouncement to hit the newspaper head-lines. I found out and bought and read his books. Here, I thought, was an opportunity in my difficulty. And I took to composting by the Indore process. At first, I wondered—where is the organic waste on this desert of mine for composting? The most remarkable feature about this composting business is that if you set about it with determination, the more compost you make the more the organic waste you find you have overlooked which is asking to be composted. This composting is a great game that grows on you.

The last 12 months, I achieved something like a 100 tons of compost. One of the goals of my third three year programme is to achieve 500 tons of compost annually. I am confident I can do it.

The nett result is that I have recreated fertility in a goodly fraction of our acreage I don't need any soil analysts to tell me so; my plants and crops give me more reliable proof. During the last three years the only use I have put my sprayer to is whitewashing my buildings. The only insecticide I use is a little "Gammexane" in my seed-store; and to get rid of fleas and lice on my live-stock.

What is most important is that I no longer need buy any manures or fertilisers. Anybody is welcome to my quota of fertilisers and groundnut cake.

I have made my desert bloom like the rose.

Crop and Trade Reports

Statistics—Crop—Gingelly—1949—1950—Madras Province—First Forecast Report: The area under gingelly upto 25th July 1949 is estimated at 308,400 acres. When compared with the area of 246,100* acres estimated for the corresponding period of last year, it shows an increase of 25 per cent.

2. The estimated area is the same as that of last year in the districts of Guntur and Kurnoool. An increase in area is estimated in the other districts of the Province. The increase is due mainly to favourable season this year and the prevalence of attractive prices for gingelly seed. The increase in area is marked in the districts of Visakhapatnam (+ 4,100 acres), West Godavari (+ 3,400 acres), Chingleput (+ 8,900 acres), South Arcot (+ 3,400 acres), North Arcot (+ 3,900 acres), Salem (+ 15,800 acres) and Coimbatore (+ 15,200 acres). The condition of the crop is reported to be generally satisfactory and the yield per acre is expected to be normal except in parts of Nellore district where the crop was affected by insect pests.

3. The wholesale price of gingelly seed per imperial maund of 82 2/7 lbs. (or 3,200 tolas) as reported from important market centres on 6th August 1949 was Rs. 35—11—0 in Eluru, Rs. 30—10—0 in Vizianagaram, Rs. 30—9—0 in Tuticorin, Rs. 30—7—0 in Tirunelveli, Rs. 29—10—0 in Tiruchirapalli, Rs. 28—5—0 in Cuddalore, Rs. 27—9—0 in Kakinada, and Rs. 27—4—0 in Salem. When compared with the prices published in the report for the corresponding period of last year i. e., those which prevailed on 9th August 1948, these prices reveal a rise of 17 per cent in Eluru, and 3 per cent in Tuticorin and a fall of 23 per cent in Salem, 22 per cent in Tiruchirapalli and 13 per cent in Kakinada.

Statistics—Crop—Groundnut—1949—Madras Province—Second Forecast Report. Summer Crop Area and Yield: The area under the Summer crop of groundnut in parts of the Madras Province during the five months January to May 1949 is estimated at 91,700 acres as against 81,900 acres estimated for the corresponding period of last year, representing an increase of 12 per cent. The increase is due mainly to the prevalence of high prices for groundnut. The yield per acre is expected to be normal in the districts of Nellore, Tiruchirapalli, Tanjore and Mathurai and below the normal in other districts of the Province. The total yield is estimated at 75,800 tons of unshelled nut as against 66,000 tons estimated for the corresponding period of last year representing an increase of 14 8 per cent.

Early Crop: The area under the early crop of groundnut (mostly irrigated) upto 25th July 1949 in the districts of Salem and Coimbatore is estimated at 148,400 acres. When compared with the area of 143,500 acres estimated for the corresponding period of last year, it reveals an increase of 3·4 per cent. The increase is due to the prevalence of high prices for groundnut. The yield per acre is expected to be normal in Salem district and below the normal in Coimbatore district. The yield in these two districts is estimated at 71,300 tons of unshelled nuts as against 71,200 tons estimated for the corresponding period of last year representing an increase of 0·1 per cent.

2. The wholesale price of groundnut (machine-shelled) per imperial maund of 82 2/7 lb. or 3,200 tolas as reported from important market centres on 6—8—1949 was Rs. 29—12—0 in Guntur, Rs. 29—7—0 in Adoni, Rs. 28—6—0 in Nandyal, Rs. 27—14—0 in Cuddalore and Salem, Rs. 27—9—0 in Hindupur, Rs. 27—0—0 in Cuddapah, Rs. 26—9—0 in Tadpatri and Rs 26—6—0 in Erode and Coimbatore. When compared with the prices published in the last report i. e., those which prevailed on 9—4—1949, these prises reveal a rise of 15 per cent in Cuddapah, 14 per cent in Guntur and Adoni, 9 per cent in Erode, 7 per cent in Nandyal and Salem, 6 per cent in Cuddalore, 5 per cent in Hindup ur and 4 per cent in Tadpatri and a fall of 7 per cent in Coimbatore.

* Revised figure including the area under the crop in the merged States.

Statistics—Crop—Sugarcane—1949—First Forecast Report: The area under sugarcane upto 25th July 1949 is estimated at 122,000 acres. When compared with the area of 124,530* acres estimated for the corresponding period of last year, it reveals a decrease of 2,530 acres or 1·9 per cent. The estimated area is the same as that of last year, in Kurnool, Nellore, Pudukottai, Tanjore and South Kanara. An increase in area is revealed in the districts of West Godavari, Guntur, Anantapur, the Carnatic, Chittoor, and Ramnad and a decrease in the other districts of the Province.

2. The condition of the standing crop is reported to be generally satisfactory.

3. The wholesale price of jaggery per Imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) on 13th August 1949 was Rs. 24—10—0 in Erode, Rs. 23—12—0 in Cuddalore, Rs. 23—8—0 in Mangalore, Rs. 22—12—0 in Coimbatore and Tiruchirapalli, Rs. 22—4—0 in Vellore, Rs 21—0—0 in Bellary, Rs. 20—15—0 in Chittoor, Rs. 18—1—0 in Visakhapatnam, Rs. 15—10—0 in Kakinada, Rs. 12—13—0 in Vizianagaram and Rs. 11—12—0 in Adoni. (From Economic Adviser, Government of Madras)

Cotton Raw in the Madras Presidency: The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February, 1949 to 26th August, 1949 amounted to 295,399 bales of 392 lb. lint. The receipts in the corresponding period of the previous year were 314,128 bales. 389,027 bales mainly of pressed cotton were received at spinning mills and 3,946 bales were exported by sea while 80,135 bales were imported by sea from Karachi and Bombay. (Director of Agriculture, Madras).

Weather Review — For August 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	4·5	−3·2	10·6
	Calingapatam	5·7	−1·1	13·2
	Vizagapatam	2·5	−2·7	14·7
	Anakapalle*	5·6	+1·2	18·0
	Samalkot*	3·1	−2·9	23·1
	Kakinada	9·9	+4·3	35·2
	Maruteru*	7·6	+1·7	27·6
	Masulipatam	7·8	+1·5	29·6
	Guntur*	6·9	+0·8	26·5
	Agrl. College, Bapatla*	11·2	+5·7	29·5
	Veeravanam * (College Farm)	7·4	(x)	24·1
Ceded Dists.	Kurnool	3·6	−0·9	16·9
	Nandyal*	3·4	−1·9	18·3
	Hagari*	2·8	+0·2	8·1
	Siruguppa*	4·5	+0·7§	12·0
	Bellary	3·7	+1·3	8·1
	Rentichintala	6·6	+3·1	22·7
	Cuddapah	8·1	+2·9	21·8
	Anantharajpet*	10·0	+5·8	28·3
Carnatic.	Nellore	9·5	+6·6	25·7
	Buchireddi-palem*	3·8	+2·2	18·3
	Madras	5·2	+0·6	21·1
	Tirurkuppam*	8·8	+3·5$	29·7
	Palur*	5·4	+0·9	21·4
	Tindivanam*	6·7	+2·7	16·4
	Cuddalore	4·0	−0·8	20·2
Central.	Vellore	8·0	+2·3	28·5
	Gudiyatham*	10·2	+6·0	27·2
	Salem	5·2	−1·4	21·2
	Coimbatore (A. C. R. I.)*	1·9	+0·6	9·3
	Coimbatore (C. B. S.)*	2·4	+0·9	10·0
	Coimbatore	6·2	+5·0	14·5
	Tiruchirapalli	15·4	+11·3	26·8

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	3·1	0·0	11·4
	Aduturai*	9·2	+5·8	17·6
	Pattukottai*	4·4	+1·0	13·7
	Mathurai	11·0	+6·9	28·3
	Pamban	2·3	+1·7	11·0
	Koilpatti*	2·1	+0·2	12·2
	Palamcottah	...	...	...
	Amba-samudram*	0·3	−0·3	6·9
West Coast.	Trivandrum	5·6	+0·9	43·0
	Cochin	18·1	+4·2	97.0
	Calicut	14·4	−2·7	111·9
	Pattambi	11·9	−3·0	80·6
	Taliparamba*	37·3	+9·8	139·7
	Nileshwar*	28·1	+4·3	144·7
	Pilicode*	28·3	+7·1$	137·9
	Mangalore	20·8	−4·7	139·6
	Kankanady*	22·3	−4·5	140·3
Mysore & Coorg.	Chitaldrug	3·4	0·0	9·7
	Bangalore	6·6	+1·6	27·8
	Mysore	4·1	+0·8	17·8
	Mercara	23·4	−3·4	93·0
Hills.	Kodaikanal	8·6	+1·6	30·3
	Coonoor*	3·0	−2·0	19·8
	Ootacamund*	5·2	−0·4	28·5
	Nanjanad*	7·3	0·0	27·7

Note :— (1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal

(3) x Readings are being recorded only from February 1948.

(4) $ Average of six years data for Tirurkuppam, and seven years data for Pilicode is given as normal.

(5) § Taluk office normal is 3·53", and Rainfall is 4·42".

(6) ... Figures are not available.

Weather Review for August 1949

The month began with an active South-West Monsoon. Widespread rains occurred along the West Coast. The vigour of the monsoon continued unabated till 6—8—1949 and thereafter it was low for a week. The monsoon strengthened again on 13-8-1949. On account of the seasonal trough of low, pressure lying from East United Provinces to North-West Bay of Bengal, there had been widespread and locally heavy showers in Andhra desa. A general rise in pressure over the country was noted on 16—8—1949. This resulted in fairly widespread rain in Kerala and South Kanara. Due to fall in pressure in the Southern Peninsula and rise in pressure at all other places on 21—8—1949, there were fairly widespread rains in Malabar and isolated showers in Tamilnad.

Owing to a discontinuity over the North-East Bay which developed into a trough of low pressure off North Coromandel Coast and a low pressure wave in the upper air off Malabar Coast, monsoon extended to Eastern Deccan causing widespread rain in Andhradesa and Tamilnad in the last week of the month. On the last day of the month, the vigour of the monsoon was felt in Malabar, perhaps due to the unsettled conditions over the Bay of Bengal.

Particulars regarding the heavy falls in August 1949 are detailed below:—

Serial No.	Date	Place	Rainfall in inches
1	3—8—1949	Mangalore	3·0
2	4—8—1949	Cochin	3·1
3	,,	Kozhikode (Calicut)	2·7
4	11—8—1949	Ongole	2·6
5	12—8—1949	Rentichintala	2·1
6	14—8—1949	Palghat	2·5
7	22—8—1949	Vizagapatam (Air Field)	5·0
8	23—8—1949	Kakinada (Cocanada)	3·7
9	26—8—1949	Tiruchirapalli	3·4
10	,,	Nellore	2·7
11	,,	Cuddapah	2·1
12	27—8—1949	Kurnool	2·0
13	29—8—1949	Mathurai	3·4
14	30—8—1949	Negapatam	2·1
15	31—8—1949	Anantapur	3·1

M. B. V. N., C. B. M., & M. V. J

OBITUARY.

We record with deep regret the death of Sri V. Achutharamayya, L. Ag., Assistant Marketing Officer, Kakinada. Sri V. Achutharamayya worked in the Madras Agricultural Department for twenty-eight years in various responsible capacities. He was very greatly responsible for the evolution of rice-strains for the Vizagapatam District. We extend our heartfelt sympathy and condolences to the members of the bereaved family.

Results of Examinations in Horticulture Courses, 1949.

List of Successful Candidates.

DIPLOMA IN INDIAN HORTICULTURE.

S. No.	Name	Register No.	Class in which placed	Ranking	Obtained Distinctions in
1	A. Adivi Reddi ...	20	I	4	Fruit Diseases.
2	C. M. Bakthavatsulu ...	23	III	19 (Bracketed)	...
3	P. S. Chandramouli (Private Student) ...	14	III	13	...
4	V. Dasaratharamayya (Stipendiary) ...	17	II	11	...
5	T. B. Dasarathi ...	1	II	10	Paper I (Fundamentals of Horticultural Science) and Fruit Pests.
6	K. Fazlulla Khan ...	22	I	2	Do. do. and Paper IV (Olericulture, ornamental gardening and other crops).
7	S. E. Kothandaraman ...	5	III	12	Paper I
8	P. A. Krishnamurthy ...	19	III	17	Fruit Diseases.
9	B. S. Kuppuswamy ...	7	II	8	...
10	H. Muddana Shetty ...	16	III	15	Fruit Products.
11	B. Narasimhan ...	18	I	3	Paper IV.
12	D. Narasimhamurthy ...	11	II	6	Paper I.
13	B. Padmanabharaju ...	12	III	19 (Bracketed)	...
14	G. Prabhakara Reddi ...	13	III	21	...
15	T. K. Ramachandran ...	10	III	18 (Bracketed)	...
16	V. Ramalingam ...	15	III	16	Fruit Diseases.
17	K. R. Raman ...	9	III	18 (Bracketed)	Do. do.
18	V. Sampath (Stipendiary Student) ...	2	III	20	...
19	T. K. Sankarasubramaniam ...	8	III	7	..
20	M. S. Sonwalkar (Candidate from C. P.) ...	21	III	14	...
21	J. Subramanyam ...	6	II	5	...
22	K. Tejappa Shetty ...	3	I	1	Paper I, Paper IV and Fruit Diseases.
23	T. K. Venkataraman ...	4	II	9	...

CERTIFICATE OF PROFICIENCY IN HORTICULTURE.

S. No.	Name	Register No.	Class in which placed	Ranking	Obtained Distinctions in
1	N. K. Achutha Menon ...	24	I	1	Paper II (Olericulture, ornamental gardening etc.)
2	M. Audinarayana Murthy (Stipendiary) ...	14	I	3	...
3	V. Appalanarashimam ...	16	III	14	...
4	K. Ayyappa Reddi ...	4	III	11 (Bracketed)	...
5	K. R. Balakrishnan ...	1	II	6	...
6	T. M. Govindaswamy ...	11	I	2	...
7	P. Guruswamy ...	7	II	4	...
8	J. Gurupatham ...	15	III	17	...
9	B. H. Kantha Rao ...	21	III	19	...
10	Ch. V. Krishna Rao ...	19	III	9	...
11	E. Lakshminarayana ...	10	III	11 (Bracketed)	...
12	S. Mangappan ...	8	II	7	Paper II (Olericulture, ornamental gardening etc.)
13	M. Narasimhamurthy ...	22	III	15	...
14	M. S. Narasimhamurthy ...	5	III	13	...
15	V. Navaratnam ...	13	III	18 (Bracketed)	...
16	K. C. Padmanabha Menon ...	23	II	5	...
17	K. Soundararajan ...	9	III	18 (Bracketed)	...
18	C. V. Subbiah ...	18	III	10	...
19	Syed Abdul Hamid ...	17	III	12	...
20	V. V. Tarakabrahman ...	6	III	8	...
21	A. Yasodaran (Stipendiary) ...	20	III	16	...

II *List of Failures:*

1	S. C. Marimuthu ...	2	These candidates are permitted to appear for the examinations to be held in 1950.
2	P. K. Raman (Stipendiary) ...	12	
3	M. Someswara Rao ...	3	

K. C. Naik,
13th August, 1949.
Fruit Specialist, Madras.

Departmental Notifications

GAZETTED SERVICE—POSTING AND TRANSFERS.

Name of Officers	From	To
Sri Chidambaram Pillai, A.	On leave,	Dy. D. A., Tanjore.
,, Chinnaswami Naidu, M.	On leave,	Dy. D. A., Bellary.
,, Govindakutty Kurup, P.	On leave,	Superintendent, Wynad Colonization, Scheme.
,, Jaganatha Rao, C.	Asst. Cotton Specialist, Nandyal,	Western Mungari Cotton Scheme, Hagari.
,, Dr. Kasinatha Iyer, S.	Dy. D. A., Bellary,	Asst. Agricultural Chemist, Coimbatore.
,, Krishnamurthi, K. S.	On leave,	Seed Development Officer for Paddy, Tanjore.
,, Lakshmipathi Rao, T.	On leave,	Seed Development Officer for Millet, Bellary.
,, Mayandi Pillai, S.	Asst. Cotton Specialist, Narasaraopet,	Northern Scheme, Nandyal.
,, Raman Menon, K.	On leave,	Asst. Marketing Officer, Coimbatore.
,, Ramana Rai, K. S.	Special A. D., Sugarcane Development Scheme, Mangalore,	D. A. O., Vellore.
,, Seshadri Iyengar, G.	Asst. Cotton Specialist, Adoni,	Cocanada Cotton Scheme, Narasaraopet.
,, Subramania Sarma, A. H.	Asst. Marketing Officer, Coimbatore,	Lecturer in Agricultural Economics, Coimbatore.
Janab Syed Mohammad Sahib,	D. A. O., Vellore,	Seed Development Officer, for Millet, Coimbatore.
Sri Viswanathan, K. B.	Asst. Paddy Specialist, Coimbatore,	Seed Development Officer, for Paddy, Vijayavada.

SUBORDINATE SERVICE.

Appointments Posting and Transfers.

The following B. Sc., Ag. Graduates are appointed as upper subordinates and are posted to the vacancies shown against each.

Name	To
Sri Bhaskara Rao, U. K.	A. D., Pollachi.
,, Chandrasekhara Rao, B.	Asst. in Mycology, Coimbatore.
Janab Ibrahim, S. P.	Asst. in Millet, A. R. S., Hagari.
Sri Jagannathan, S.	A. D., Villuppuram.
,, Krishnamurthi, P.	Asst. in Chemistry, Coimbatore.
,, Lakshmanan, N.	A. D., Palladam.
,, Nagarajan, S. N.	Asst. in Entomology, Coimbatore.
,, Periaswami, S.	Asst. in Entomology, Coimbatore.
,, Padmanabha Rao, T. R.	Asst. in Entomology, Singampatty.

Name	To
Sri Purusothaman, G.	P. P. Asst. in Entomology, Vellore.
,, Ramachandran, L.	A. D., Darsi.
,, Raman, N. V.	A. D., Avanashi.
,, Sri Ramulu, C.	Asst. in Millet, A. R. S., Nandyal.
,, Sanjevi, P. S.	Asst. in Millet, Coimbatore.
Sreemathi C. K. Rajam,	A. D., Tiruchirapalli.

Names	From	To
Sri Antony, J. S. C.	On leave,	A. D., Kallakurichi.
,, Anantha Rao, K.	A. D., Chicacole,	A. D., Tekkali.
,, Baskara Rao, M. V.	On leave,	A. D., Chintalapudi.
,, Chockalingam, M.	Asst. in Chemistry, Coimbatore,	F. M., Central Farm, Coimbatore.
,, Devasikamani, J.	F. M., Bhagavathi Farm, Siruguppa,	F. M., A. R. S., Siruguppa.
,, Gopalakrishnan, A.	A. D., Tekkali,	A. D , Chicacole.
,, Jayaraj, M. V.	Asst. in Cotton, Coimbatore,	Asst. in Cotton, Trichengode.
,, James Colaco,	Special A. D., Sugarcane Scheme, Mangalore,	F. M., Nileshwar, II.
,, Krishnan, T. B.	A. D., Avanashi,	Asst. in Cotton, Coimbatore.
Janab Mohammad Fasiuddin,	A. D., Anakapalle,	A. D., Bhimlipatam.
Sri Muthaiah, V.	Asst. in Chemistry, Coimbatore,	Asst. in Paddy, Coimbatore.
,, Narayana Iyer, N.	On leave,	A. D., Gudiyattam.
,, Rama Rao, B. K.	A. D., Karkal,	A. D., Hosur
,, Subba Rao, A.	On leave,	F. M., Bhagavathi Farm, Siruguppa.
,, Siva Ramakrishnaiah, Y.	A. D., Bhimlipattam,	A D., Anakapalle.
,, Sadasiva Shetty, Y.	F. M., Cotton Breeding Station, Coimbatore,	Asst. in Cotton, Winter Scheme, Coimbatore, P.
,, Srinivasagopalan, D.	On leave,	P. Asst., in (Mycology) Tiruchirapalli.
,, Sethumadhavan, R.	P. P., Asst. in (Mycology) Tiruchirapalli,	P. P., Asst. in (Entomology) Tanjore.
,, Suryanarayanamurthi, T.	A. D., Darsi,	Asst. in Millet, A. R. S., Guntur.
,, Satyanarayana, T.	Special A. D., Tobacco Scheme, Sindarampatti,	A. D., Guntur.
,, Vaidyanathan, J.	On leave,	Special A. D., Tobacco Scheme Sendarampatti
,, Viswam Iyer, K. E.	On leave,	A. D., Mathurai.
,, Visvanathamurthi, K.	F. M., Siruguppa,	F. M., Bhagavathi Farm, Siruguppa.
,, Vasudeva Menon, K.	On leave,	Asst. in Chemistry, Coimbatore.
,, Viswanathan, M. A.	Asst. in Cotton, Coimbatore.	Asst. in Cotton, Avanashi.

The following candidates are selected to undergo the certificate course in Horticultural Training for a period of one year at Madras.

Names	From
Sri Anthoniswamy, N.	Nellikuppam.
,, Charles Stephen.	Coimbatore.
,, Haridas, C. M.	Wynad.
,, Lakshminarasimham, G.	Nellikuppam.
,, Pydayya, P.	Madras.
,, Ramaswami, R.	Tanjore.
,, Sambandam, G.	Coimbatore.
,, Nageswara Sarma, V.	Maruteru.
,, Sheith Abdul Sammad.	Sidhout.
,, Venkatesan, N.	Lalgudi.
,, Venkata Ramanan, R.	Nellikuppam.
,, Subba Ramaiah, M. V.	Eluru.

Agriculture College and Research Institute, Coimbatore.

LIST OF ADDITIONS TO LIBRARY FOR AUGUST 1949 (Book Only Listed)

1.	GOHAR (N):	Mycoses and Practical Mycology	1948
2.	BAILEY (Altone) Editor:	Cotton seed and cotton seed products—their Chemistry and Chemical Technology.—	
3.	GANAPATHY IYER (S. K.):	Kozhippannai (Poultry Farming) in Tamil 3 copies	1949
4.	PROCEEDINGS of the 6th International Conference of Agricultural Economists held at Darlington Hall, England, 28th August to 6 September, 1947.		1948
5.	MALHERBE (IDe. V):	Soil fertility	1948
6.	Reports of the Co-operative planning Committee appointed by the Government of India on the recommendation of 14th Registrars conference		
7.	SALIM ALI:	Indian Hill Birds	1949
8.	Thackers Indian Directory of India and Pakistan		1948—49
9.	HOARE (A. H):	Fruit Culture	1948
10.	ROMANOFF (Alex L.):	Avian Egg:	1949
11.	Bibliography of Soil Science, Fertilizers and General Agronomy 1944—'47		1948
12.	MOYER (JAMES A):	Air Conditioning	1938
13.	MOYER (JAMES A):	Refrigeration including air conditioning and Cooling and household automatic refrigerating machines	1932
14.	CULPIN (C):	Farm machinery	1947

D. B. K.

The Madras Agricultural Students' Union.

PATRONS.

1. Sri V. Arumugam Pillai, Sundaikamuthur, Coimbatore District
2. Dewan Bahadur C. Arunachala Mudaliar, Zamindar of Chunampet, Chingleput District
3. Raja Sri Krishnachandra Gajapathi Narayana Dev, Maharaja of Parlakimidi, Ganjam District
4. Raja V. Madhava Rajah of Kollengode, Malabar District
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The Madras Agricultural Journal

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TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high — and the Editorial Board will feel obliged if your articles are brief.

The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI　　October 1949　　No. 10

Editorial

Training the Research Worker: The reorganisation of scientific research and university education in Independent India, on lines, which would enable her to keep pace with the rest of advanced countries in the world, in the matter of industrial and academic progress, is now engaging the attention of our statesmen and leading scientists. In the editorial columns of a recent issue of 'Nature' are discussed certain aspects relating to modern trends in organisation for scientific research, which are well worth a close study. "The division of the world into two sharply contrasted groups has repercussions in the field of science and of scientific research if no more than as affecting the ideas which men hold about the freedom of science". The progress in pursuit of knowledge is made rapidly and securely only when individuals are free to entertain any hypothesis, and when the survival of the hypothesis is determined soley by the rigour of test against cold facts, and not by any arbitrary ruling: and political dogma should never be allowed to dictate the teaching and practice of science". In selecting personnel for scientific research it is of utmost importance that the individuals chosen should have besides outstanding intellectual urge, of a personal nature, the ability to co-operate with collegues of equal attainments and ambitions. As much of modern advanced research is team work carried out on a planned basis, the possibility should be avoided of an obdurate lone worker impeding the evolution of joint integrated programme of research by a group of men. The most important single attribute of a scientific staff should be the ability to perform as a group the function estimating and balancing integrating and interrelating. The importance of universities maintaining their independence is emphasised for the main source from which to draw the research workers for scientific development will be the universities. The academic values of passion for truth, thoroughness in pursuing it to its end, a delicate precision in analysis a judical temper a willingness to learn from all quarters

and an uncompromising insistance on freedom of utterance, should be upheld as basic values in any university worth its name. Any teacher who tolerates intellectual dishonesty is out of place in an university. · Over adulation of post graduate research results in the fresh student not educating himself. "A university needs to encourage and honour not only discoverers of facts but also explorers of ideas and appraisers of values. If it does this and can at the same time mark out those relatively few whose talents appear to fit them preeminently for a course of research it will have done more to meet the needs of Academic research, the Research Institutions and Industrial Departments than by fostering large, schools of directed research. The post graduate side of a university should never degnerate into a research factory. The Universities should bear in mind that they have to justify the public expenditure on them by returning to the nation men and women of trained first class minds capable of filling responsibilities of leadership, of character, ability and high standards of technical skill.

Agricultural Research and Propaganda: Our readers have been presented with several views on this problem, dealing in detail on aspects of acquainting the cultivators with the progress in research. Almost all of them have struck the same path, and stress the use of films, radios, talks, lectures, songs, leaflets etc., while some of them have doubted the efficacy of district farms in this aspect. Mr. Naik, however strikes a different path. He argues that such methods of propaganda copied from other countries and transplanted into an Indian village at the present state of development does not bear fruit. He stresses that for the majority of the cultivators actual demonstration on the spot living the cultivators own life but at the same time demonstrating what could be done leaves a deeper impression. The Model state Farms as he calls them should be distributed through the entire province. In short the main theme of his argument is that example is better than precept.

Our Prime Minister: The Prime Minister of India has been sojourning in America and we learn with pride that he has been given a rousing reception. We earnestly hope and pray that the visit of the Prime Minister will mark a beginning of active co-operation of the eastern and western himspheres, for the welfare of the people of the world and ensuring its peace.

Research and propaganda, a plea for re-orientation*

By

K. C. NAIK

(Fruit Specialist, Madras)

In our drive towards self-sufficiency in food production, the paramount need to pass on the results of research to the ryot with effect, economy and expeditiousness has been stressed from all quarters. It will be generally conceded that our propaganda organisation in all parts of the country has been modelled more or less on a uniform pattern with taluk or district demonstrators forming the main core of the organization and with seed, manure and implement distribution as their chief functions. Intended primarily to be the mentor and guide to the ryot and overwhelmed by a lot of routine and more recently by the trading scheme duties, the advisory activities of the demonstrator have receded to an extent to the background. Even under normal times, it is doubtful if the rigid compartmentalisation of extension service and research wing is conducive for efficiency. With no direct contact with any field of research and with little or no scope to keep himself abreast with the day-to-day advance in progress of agricultural science in its varied forms, the demonstrators' advisory function cannot but reduce itself by force of circumstances to a few set maxims, which may be monotonous to the well-informed ryot and rusty or even obsolete from the modern scientific standards. This eventuality may be an extreme conception, but the very possibility of it should make us think of a plan that would perpetually maintain the keen edge of propaganda in such a manner as to influence the agricultural practice to the maximum and widest extent possible.

If we accept, as we must, that extension service should be constantly fed by the results of research, it follows that there should also be a vehicle through which this free flow of knowledge between the two lines of departmental activity is possible. It has, however, to be remembered that research is proverbially slow and uncertain of results. Our popular crop strains and most of our improved agricultural tools and practices have been evolved or chosen for advocating to the ryots after years of toil in laboratories and fields and after laborious tests. This is why most of the items of our propaganda of to-day are not far removed from those a decade or two ago. Our annual reports of agricultural stations can never claim to make substantial additions to alter the course or shape of extension service every time they are issued. They only register the milestones in our progress in research activities and do not delimit the destination point. It would be as ridiculous to expect our research stations to produce an efficient crop strain every year, as it would be to expect an improved agricultural practice to be recommended with every change of demonstrator in

* Paper presented at the 32nd College Day and Conference.

any centre. The research reports produced annually are essentially comprised of hypotheses, which are the pre-requisites of inferences. While these reports are important to scientific workers in affording the only reliable means of judging the appropriateness of approach to the problems and of the extent of advance made towards the solution of a problem during the period, they cannot be of much help to alter the lines of propaganda or enhance the benefits therefrom. It will be risky, if not positively dangerous, to model our extension work on hypotheses and surmises.

The only rational view under the circumstances is that, while the extension worker has to be always alert to imbibe the periodic progress made in the field of research, his *modus operandi* may not lend itself for frequent changes, owing to the fact that the stimulus for such changes is unpredictable in origin. This cannot be an argument for divorcing extension work from research, but for vigilance combined with inter-dependance.

From the point of view of the practical agriculturist, the departmental propaganda is of two distinct categories, one that will cater to the vast majority of what may be called as the conservative or relatively backward section of ryots, and the other that will meet the needs of the more progressive but smaller section. The value and extended use of green manures, of soil production and conservation, of compost making and exploitation of farm waste materials, roguing out in nurseries and fields, of maintaining purity of seed material, of growing only strains of proven merit, of the timely and adequate control of pests and diseases, and of a proper crop rotation—these are types of propaganda that are applicable in most years and seasons and in wide stretches of the province more or less on a standard regional basis. Every ryot needs to be impressed on the value of each of these measures; some repeatedly and some occasionally. There are no two opinions on the value of these items of propaganda and there is no special type of mental equipment or skill needed for carrying out the extension work in respect of such items. It may be unnecessary, if not useless, to employ scientifically trained agricultural graduates for this type of extension work, which has varied little with the passage of time.

It seems that these items of propaganda can be entrusted with economy and advantage from the view-point of effectiveness to picked but practical ryots, who by virtue of their status and character, enjoy the confidence of a bulk of ryots in a village or firka. Our agricultural propaganda in the past half a century or more can be expected to have permeated sufficiently wide as to make it easy to pick out a number of ryots in each firka, who adopt some, if not all, of the departmental recommendations. The selected propagandists may hold office for a period of two or three years, during which it should be possible to expect of them to model their own farming practices strictly to conform to all what we advocate. Who can fill the role of propaganda better than the owners of

such model farms? A short course of training may perhaps be necessary before these men are drafted for their part-time duties, but this can be done by the trained agricultural demonstrators. The remuneration of these village propagandists may be sufficiently attractive as to provide the incentive to continue the performance of the duties with devotion and enthusiasm. This type of practical part-time and paid agricultural propagandists is by no means a novel scheme. The village officers as the Karnam and Village Munsiff are also part-time Government servants. If our whole land revenue system is worked by such a medium, there is no reason why the agricultural system cannot be made to develop and improve on a similar pattern. The agricultural improvements can be expected to be more speedy and tangible when it is vested in the hands of persons who live amidst the ryots, move daily with them, speak their language, share their thoughts, participate in their joys and sorrows and possess a tie of kinship in innumerable ways. The highly trained and sophisticated propagandist from a taluk or district headquarters has often been dubbed a misfit in our village atmosphere and can hardly inspire confidence among the villagers. The taluk demonstrators may continue to exist in order to train, guide and supervise the work of these village or firka agricultural propagandists and to enforce the conditions that every propagandist should himself set the example by practising all the precepts that he preaches. This is an acid test for the success of the scheme. To enhance the utility of the scheme, it will be desirable to select these ryot propagandists annually or every two or three years. The selection may be on a competitive basis as judged on the nature and quality of work done and on the excellence of agricultural practices achieved, and also on the propaganda ability possessed by the candidates. The system is designed to promote and foster a healthy spirit of competition among the ryots, which by itself will be a fillip for agricultural improvements.

In effect this system will lead to the establishment of model farms in every village or firka without any Government funds being directly expended on them. An outcome of the implementation of the above proposal will be that, while it will cater to the vast bulk of ryots who are amenable to this type of propaganda by persons living and mixing with them always, the progressive, educated and scientifically alert group of farmers have to be provided differently and at a higher level. This group of persons, though numerically small, is generally more well-to-do and is, therefore, readily responsive to well-informed propaganda. They are practical, intelligent and do not need the type of extension service dealing merely with elementary items of which they are already aware. They are not of a type to take any new improvement without question but no new improvements can be popularised except after convincing this group and then arranging to disseminate to the more conservative section of the ryots citing the examples from richer educated sections. Particularly in

the field of horticulture, the demand for advice is from an intelligent class of ryots who may themselves be fairly advanced in their art. This class of people can be tackled only by well-trained persons actually in contact with farming practices and research and specially trained for their duties. A district officer solely engaged in routine work and with no opportunities to take active interest in research may be adequate for guiding the propaganda intended to popularise well-known practices and strains of proven value. Subjects that require specialised knowledge, skill and careful planning, born of conviction and awareness of the value of scientific farming, can only be dealt with by a different type of propaganda personnel for which a separate organisation seems necessary.

Clubbing these two lines of propaganda under one wing has been in a large measure responsible for the ineffectiveness of our extension work in the past. It is as useless to enunciate the finer scientific principles to an uneducated and unintelligent ryot, as it would be to din the commonplace to the progressive farmer. Above all, the prevalent and erstwhile system may often serve only to lower the efficiency and standard of propaganda workers, who are not provided with any incentive to keep themselves abreast with scientific advances.

Summing up the present position, it would appear that a re-orientation of our extension service is urgently called for. In this the balancing of research and propaganda activities must occupy the premier place. The free flow of information for efficiency in propaganda must be ensured by firstly, extending and intensifying research and secondly, by providing for a more intimate link between research and extension work. The compartmentalisation of research and propaganda only serves to antagonise these two wings of the department to the detriment of both, and more important still to prejudice the farmers. To cut across the existing anomaly, it may involve a thorough overhaul of the departmental organisation. In considering this subject one of the most common errors which, we are apt to fall into, is to stress the so-called analogy from other lands chiefly from Europe and America. The efficiency of any publicity or propaganda campaign must depend to a very great extent on the mental calibre of the persons for whom such a campaign is meant and to even greater extent on their psychology, their training, language, environment, economic condition, character, national, regional or communal habits and social set-up. Those who suggest a specific type of propaganda for a province or a country on the analogy of American or European model are only over-simplifying the problem, which is not the same thing as solving it.

Organisational efficiency combined with a high educational standard and high standard of life may all demand a type of publicity or propaganda campaign quite different from that to benefit an economically backward country like India. The Californian Orange Growers Exchange

is reported to have spent over £ 1,25,000 in Great Britain alone in a period of four years for advertising the value of grapefruits as a breakfast food, and with such effect that to-day the grapefruit has become an almost universally favourite food to start the day with, in innumerable British homes. We can well imagine the tremendous loss to the Exchange if such a publicity campaign had been conducted in India. Our food habits and tastes as well as the educational backwardness and low economic conditions of our masses will all have provided an arid barren ground on which all the advertisement talent and money would have been wasted.

If our existing propaganda is a misfiit, or not sufficiently effective, and foreign methods cannot be easily adopted in our country, what is it that we can suggest as a solution? An answer to this should have to take note of all the peculiarities of our Indian ways of life, and of our mental make-up. One of the foremost points that merits attention in any discussion on the suitable type of propaganda for agricultural improvement is the fact that unlike in most countries, our agricultural farming is composed of two main classes of persons, one, consisting of a majority of tenant farms and the second of a minority of rich landlords. The former are generally impervious to our propaganda, steeped as they are in poverty and with no educational or cultural attainments that can enable them to appreciate closely reasoned advice, in whichever manner it reaches them. In a land of peasant proprietors, owning the land they till, and where the benefits of every improvement adopted is to be reaped by the owner of the land himself, the urge to search for every means of improving the agricultural practice is perpetual. The higher standard of life and the markedly higher economic condition of the agriculturists are other favourable conditions for the successful working of the propaganda machine. On the other hand, in this country it often happens that the richer class consists of either absentee landlords or those having only a casual interest in certain types of agricultural improvements, such as that of improvement of irrigation facilities due to which the results are speedy and ocular and the returns appreciable to the landlord. Against this background of India's agricultural set-up, it is idle to expect that the provision of a propaganda officer such as an Agricultural Demonstrator at the rate of one per taluk solely for propaganda and without any other ramifications of direct extension service, can result in any appreciable improvement in our agricultural prosperity, especially as such officers have no means to effect any change in the numerous handicaps that the common ryot is suffering from.

Regarding the methods of propaganda also, it is common to hear among the suggestions for improvement some quite attractive and apparently efficacious ones, but which are totally divorced from the realities of the situation. If films have shaped the habits, dress and culture of people in foreign countries and even in some of our urban areas,

we should not expect equally tangible or spectacular results through this medium for agricultural improvement. It is doubtful if even a small section of actual agriculturists attend the cinema; and among these that do so occasionally, whether even a fraction of the people are convinced of the utility of a recommendation. For many years to come, films will remain a pastime; and their educational or cultural value is yet to be proved on a mass or country-wide scale as in India. At best the film may just ruffle the still pools of thought and afford a comparative idea for discussion. But the age-long agricultural practices of our forefathers are not likely to get a material shake-up by a few film shows. Man's mind is not pliable, nor our country so small, nor our agricultural practices so few and so standardised, nor our film publicity for agricultural propaganda so perfect, as to work a miracle in our agricultural farming.

Lectures and radio talks as well as the exhibitions on shandy days or along with reputed local events and celebrations, cut no more ice than film propaganda. Here the means of propaganda is primarily personal in nature and its merits or demerits are liable to be altered, depending on the lecturer or showman and his capacity for the task. Who does not know the wearisome boredom that most in a rural audience experience after hearing some long speeches of extension staff? To believe solely on this type of propaganda to do the trick, is to continue the game of self-delusion. Almost on the same part are the departmental publications. Most of these are beyond the reach of the average ryot; the few who read them take only a casual interest in such media of propaganda, and only a small section of the ryots are actually benefited by it appreciably.

This leaves out one type of propaganda which, in my opinion, has not had a real trial so far in India. I refer to the establishment of a network of Model State Farms at the rate of one per taluk. All these state farms should be laid out and run in an up-to-date scientific manner, where only the best strains of crops are grown under ideal conditions and where bumper crops are gathered, and where precise cost of production and of revenue are worked out for any who care to study them. Each of these farms should be in the charge of men, who have had not less than 5 years of farming experience and preferably 10 years. With a minimum staff responsible to the Chief Farm Manager, and for assisting him, this farm should demonstrate what is possible through scientific agriculture. The staff should all have good and decent quarters and all possible amenities, so that the form should be the ideal in every way to the ryot, showing him what comforts and conveniences one can enjoy and yet secure higher margins or profit from agriculture than by the present methods. The farm may meet the demand for pure seeds, for tools, manures and insecticides and fungicides and other agricultural requirements, for all of which there may be an assistant under the supervision of

the chief Farm Manager or the District Agricultural Officer, whose headquarters may also be at the same place; and both to be under the control of the Regional Deputy Director.

In conclusion, it is well to bear in mind that propaganda when not well fed by results of research can be just a flop, if not a tragedy. Even so, the methods of extension work can cut no ice if they are not shaped to suit the calibre, prejudices and socio-economic habits of our people. For securing utmost efficiency with economy, the extension work shall have to be integrated with research, and it is suggested that Model State Farms in each district and taluk with propaganda personnel drawn from every village or groups of villages from amidst practical agriculturists and who should themselves be maintaining model forms, offers the only feasible plan of action. The demonstrator of to-day and the common ryot are two apparently incompatible entities, and so are the former and the scientifically progressive specialised producer of crops like fruits, vegetables, spices, plantation crops, etc. It is time we evolve a plan in which the results of research are transplanted to different classes of ryots by persons of different calibre and training. State Model Taluk Farms dealing with all crops of importance to the taluk will provide just that reliable ocular demonstration which all can accept without question. Such farms with their skilled and practically experienced staff can find just that meeting ground with the progressive section of our ryots, which is sorely lacking to-day. To the rest of the ryots, the unofficial model farm maintained by the part-time village propagandist who are themselves practical farmers, will afford a perpetual object lesson, providing at the same time a most economic and efficient medium for the spread of all scientific agricultural improvements.

Crop planning for the Thungabhadra Project ayacut*

By

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(Deputy Director of Agriculture, Thungabhadra Project, Bellary)

The Thungabhadra Project, as now finally proposed, is intended for the benefit of the stretch of country along the course of the river of the same name and lying in a 10 or 20 mile depth southwards in the districts of Bellary and Kurnool. Started at first almost wholly as a protective scheme for the famine stricken areas of the two districts, it is now being planned as a developmental programme aiming at increasing the general standards of living of the people of the area through improved agriculture and industrial ventures of assured profits.

*Paper presented at the 32nd College Day and Conference.

The parts of the province actually coming under the project, have in fact several of the requisites for operating successfully programmes of development. They are,

(i) the area will soon come to possess facilities for power and water for irrigation. There will be great scope for varied types of economic development with intensive and choice agriculture as the background.

(ii) It has, like other tracts where developmental programmes were worked with success, a geographical unity over a wide enough landscape and enjoys a considerable measure of unified and administrative control and has a homogenous population.

(iii) the tract is characterised by only two types of soils mainly the red and the black almost wholly uninterrupted by intrazonal spreads, which makes for easy and efficient planning of cultivation systems.

(iv) being subject for ages to an arid but not desert type of climate and derived mainly from lime-rich parent materials, there is, over its greater part, considerable depth of fertile soil material of high productive capacity. Adequately manured, it is possible to obtain ordinarily a five to six fold increase of cereal yields and three to four fold increase of economic crops like cotton and groundnut. It is further possible to raise a variety of crops of industrial and agricultural value. There is thus great scope for planning for profits, but the one main factor that stood, for long, in the way of development, was its uncertain and precarious rainfall; the advent of the project opens up the prospect of launching, with surity of success, developmental schemes to all of which the agriculture of the tract is basic. However, certain peculiar features, of the tract as a whole demand primary consideration and efficient and ordered handling; planned production and perhaps, production of even specified kinds, appears needed if the success envisaged should be realised.

Lack of adequate capital: Irrigation agriculture offers certain difficulties in its immediate practice on the undulating terrain of the area and the lands require a minimum of improvement in the shape of levelling and terracing before water can be used on them; and this has been estimated as likely to cost considerable sums. The average ryot may find it either too high for his means or may lack the strength of sufficient faith in the need for the improvement. Even more important than the above is the consideration of "men and means". The tract has an average population density of only 200 per million and a cattle wealth which admits of only one pair for every 30 acres of cultivable land. It has thus too few men and fewer cattle for the high level of cultivation required under irrigation agriculture. With the natural tendency of the ordinary ryots to grab at more land than he can effectively handle or

manage, unprofitable systems of development may come to be practiced, for long enough period leading to deterioration of the land and decreasing levels of crop production. Crop planning and if necessary even its enforcement may therefore have to be given high priority in the scheme of things that will make for the assured development of the area.

Results of the Agricultural Research Station: Work has been going on under government auspices for over a decade and has now reached a stage when there are available a large number and variety of crops that can be raised at remunerative levels. We have in addition sufficient knowledge of the water and manure requirements and optimum periods of growth for fitting the crops on to the soils and seasons in any desired or planned manner. With the crops commonly cultivated in the tract, it may be computed that a net increased return ranging from Rs. 33 to 83 per acre can be expected under irrigation and ordered planning to fix these crops into suitable cropping schemes and to regulate their relative extents should prove of great value.

Information on such plans is, however scanty and the few lines that have been worked so far are of the nature of a simple introduction of the existing crops and schemes of cropping into the newer conditions. In the dry cultivated tracts of the area, crop planning is based on the same crops as above; jonna and groundnut being raised on red and shallow black soils, in the Mungari season; cotton being raised in the heavy black soils, in the Hingari season. Experience on the farm has led however to the conclusion that while adequate profits can be realised by irrigating these crops, the detailed plans of cropping the lands in Mungari and Hingari seasons require considerable modification before the water of the project can be made use of for irrigation. The conclusions arrived at were, (i) the adaptation of the existing dry land scheme to irrigated areas requires the segregation of the lands into Mungari and Hingari blocks and this would greatly disturb the agricultural economy of the ryot giving more food to the mungari ryot and more money to the Hingari ryot and (ii) the alternative plan of rotating the lands between the two schemes of Mungari and Hingari cultivation presents difficult problems of cultivation.

Indications of work during these earlier years on the farm work, on allied aspects of crops and seasons and cultivation open up the possibility of circumventing the above difficulties and of devising of different plan of cropping with the same background of finding for each ryot, some food to eat, sufficient fodder to feed his cattle on and as much money in addition as he can get for purchasing his other requirements. Under irrigation it has been found possible, in fact desirable, to grow the Hingari crops early in or even before the Hingari season, thus obliterating to a large extent the differential effects of the two seasons. This

enables a uniform cropping plan for both the seasons with all the advantages of irrigation agriculture. As instances of cropping plans of such general applicability may be cited the following which are now under study at the agricultural research station,

	Sown in	Harvested in	
Groundnut and Red gram	June — July	Sept. — Oct.	1st year.
Jonna	June	Sept. — Oct.	2nd year.
Green manure followed by wheat	June - Oct. — Nov.	August — February	3rd year.
Cotton	August	March	4th year.

Whatever may be the final outcome of these trials, the two schemes have much in common in both their immediate aims and methods used. Their aim has an essentially rural background more food, surer food and as much extra money as can be had. This is much unlike devolopmental schemes of compact areas in other parts of the world and if maximum benefit is to be derived from the use of the facilities of power and water, the aim of our planning may well be "adequate food if possible but at any rate adequate means to secure same".

It is worth while examining the formulating of the conditions that planned production should aim at satisfying. The objective of all schemes of agricultural development should either be a state of self-sufficiency in respect of food requirements which may be considered full in itself; or one of specialised development with an industrial outlook. The former is beyond doubt of paramount importance in the development of an administrative unit as a whole such as that of a province or a country but in trying as in the present case of developing a compact region of a major province, considerations of over all gain to the tract in question may take precedence over mere insistence on a self-sufficiency plan in respect of food. The objective set by the author of the special investigations of the condition of the project, Sri T. N. S. Raghavan, and on whose findings the work of the project is being defined and ordered, is rightly the latter one of an integrated development of the tract as a whole.

Against the above background, I have examined below the implication of a self-sufficiency programme to the future prosperity of the tract. It is well to emphasise even at the outset that, so long as the cropping plan for the tract aims at increased production of the same crops as the dry tract, programmes of self-sufficiency should be formulated for the entire area of which the developmental region forms a part. This is particularly the case in the present instance as most of the organised markets lie outside of the project area.

An analysis (vide appendix) of possible production of the cereals and the requirements of the population for self-sufficiency given below making use of the method adopted by Sri S. Y. Krishnaswami Iyer* in his monograph on rural problems. On the basis of this analysis, self-sufficiency cannot be attained as a result of the available irrigation facilities and it is worth while examining if and to what extent emphasis can be shifted to industrial crops. We have at present insufficient data to decide these issues; but the possibility of planning the agricultural economy of the tract on the model of other food deficient areas, (like Malabar or Travancore in the Province or Malaya, Ceylon, Java etc., outside India) may prove of more lasting benefit.

APPENDIX

Population of the districts of Bellary and Kurnool.	22 Lakhs.
Increase of labour population that is needed for practicing irrigation (66% of the population of the ayacut).	1·8 lakhs.
Total population of the two districts.	23·8 lakhs.
Total population in terms of equivalent adults.	23·8 x 0·75 or 17·85 lakhs.
Food requirements in tons of husked millets required to feed the above population at 28 oz. per adult per day.	4·46 lakhs of tons.
Available food (including the average increased production under irrigation agriculture of the proposed area):	
Production in tons of dehusked millets	Bellary : 167,000. Kurnool : 172,000
Anticipated increase in tons of dehusked millets estimated to result for the use of irrigation of tract:	45,000
Production of paddy in terms of tons of rice for the 36,000 acres of the ayacut at 2,000 lbs. of paddy per acre:	20,000
Total production available:	4·04 lakhs.
Deficits:	0·46 lakhs of tons of dehusked millets.
Area required:	69,000 acres.

*Krishnaswami S. Y., 1947 Rural Problems in Madras Presidency — a Monograph — Superintendent Govt. Press, Madras.

A study of the composition of well waters in and around Bapatla

By

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PART I.

With the starting at Bapatla, in July 1945, of the second Agricultural College, one of the prime considerations was to ensure a continuous uninterrupted supply of water for the College laboratories and for the residential hostels. At Bapatla the soil is sandy, and the water table is very high, being almost within 2 feet from the surface during the rainy months and about 8 to 10 feet in the summer. A common feature of the tract is the presence of a number of '*doruvus*' scattered within a few yards' distance of each other. A *doruvu* is a shallow excavated depression about 8 ft. deep, the cost of getting one ready being within Rs. 10 to 15. These are the sources of irrigation, which is done by splashing, for crops, like paddy and tobacco nurseries, ragi, brinjals, chillies and other vegetables raised round about Bapatla.

At the time the building and site were acquired for the college, there were a few *doruvus* of this type within the premises, with built-up parapet walls. One of these, near the hostel was decided upon to supply water to the new college. A pump was installed in this well and water pumped to overhead tanks of the college building to meet the needs of the college laboratories and the hostel. It was soon found that the well was not able to cope up with the demand for a continuous supply of water; the water in the well got exhausted within four hours and a sufficient interval had to be allowed for percolation, before pumping could be started again. Proposals were therefore contemplated to increase the water supply, either by deepening the well or by digging some more wells. As a preliminary to such deepening it was considered desirable to have an idea of the composition of the water of some of the wells in the locality and of the effect of such deepening on the concentration of salts. A start was made with three wells in the college compound, one of which was the hostel well itself; the analytical data pertaining to them are given below.

	Hostel well	Botanic Garden well	Well near the College building
		(Parts per 100,000)	
Calcium bicarbonate ...	43·73	32·51	21·06
Calcium sulphate ...	2·40	9·46	5·37
Magnesium sulphate ...	15·45	8·54	1·92
Magnesium chloride ...	11·28	...	...
Sodium sulphate ...	...	35·79	39·17
Sodium chloride ...	70·96	52·50	28·91
Total of calculated salts ...	143·82	138·80	96·43
Total solids at 105° c ...	179·00	151·00	86·80

All the three wells are within a short distance of each other, the well on the south of the college being about 50 yards from the Botanic Garden well and the hostel well being a further 100 yards on the east from the college well, which is more or less midway between the two. It will be noticed that there is variation in the composition of water in the three wells, the Botanic Garden well being the worst in concentration, the sulphate and choloride of sodium accounting for about 70% of the total salts; the hostel well water also contained magnesium chloride and no sulphate, unlike the other two wells.

The next anälysis undertaken was with reference to a number of *doruvus*", which were found near the college sports ground. Near this area, plots carrying sweet-potato and millet varieties were laid and in the centre was a patch which was alkaline with white incrustation and where the crop growth was extremely poor. The analyses of six of these '*doruvu*' waters are given below.

	I	II	III	IV	V	VI
			(Parts per	100,000)		
Calcium carbonate ...	...	1·37	...	1·37	2·46	2·73
Calcium bicarobonate ...	24·29	21·24	57·54	49·43	20·58	34·85
Calcium sulphate ...	...	...	3·30	40·19	...	4·37
Magnesium bicarbonate ...	9·54	16·74	...	...	8·85	...
Magnesium sulphate ...	6·51	...	28·58	..	9·08	21·08
Magnesium chloride ...	...	...	30·77	32·15	...	5·65
Sodium bicarbonate ...	...	4·5	...	...	...	...
Sodium sulphate ...	1·50	12·2	...	...	...	...
Sodium Chloride ...	19·04	23·65	55·73	64·06	20·77	62·88
Total of calculated salts ...	60·88	79·70	175·92	187·20	61·74	131·56
Total soluble salts ...	63·30	87·60	210·0	205·0	57·3	120·0

Once again it will be seen that sodium chloride is an important constituent; magnesium chloride was also found in varying amounts and the *doruvus* with the largest amounts of sodium and magnesium chloride (samples III and IV of table) were those found near the alkaline patches. Considering that the '*doruvus*' were near each other, (i. e., within an area of about 30 cents) the data showed much variation in composition, but it was found that the *doruvus* on the western side had a lower concentration than those on the east.

Following this, a number of '*doruvus*' and wells were examined outside the college area, in various parts of Bapatla town and the same observations were confirmed; viz., a wide variation in composition in wells within a short distance of each other, and the presence of magnesium chloride in varying amounts in the water of most of the wells.

In the meanwhile, the Industrial Engineer had been addressed to carry out boring trials within the college compound to locate, if possible, the most copious source of water supply. He started his work in the summer of 1946 and advantage was taken of his boring apparatus to obtain samples from different depths and to carry out analyses on them. Five spots within the college were examined.

I. Bore Trial: In the sweet potato plot near the students' hostel and close to the eastern boundary fence. (About 200 yards east of the college).

II. Bore Trial: On the eastern side of the pond near the dairy (About 150 yards E. S. E. of oollege).

III. Bore Trial: Near the college bus stand—(About 50 yards S. E. of college).

IV. Bore Trial: Near the gas house, (about 50 yards N. W. of the college).

V. Bore Trial: On the western side of the dairy pond (about 80 yards E. S. E. of the college).

At each spot a sample of water was drawn as soon as water appeared, noting at the same time the depth below ground level; thereafter, a sample was drawn for every successive 2 feet depth bored; up to a depth of 30'. In one of the spots (III) samples of soil were also drawn at every depth along with water, for later analysis. In all the spots it was noticed that upto the depth examined, namely 30', the soil was only sandy; no rock, either weathered or unweathered was noticed. Altogether 70 samples were examined and the results are presented in appendix 1. It will be seen from the figures, that in all the five borings, there is a sharp and sudden rise of total soluble salts, below a depth of 16 feet from ground level. Again magnesium salts increase in concentration,

only below this depth. Generally the upper layers (i. e., above 15′) contain 40 to 50% of calcium salts, O to 10 of magnesium salts and 40 to 50 of sodium salts.

The following conclusions are possible from the data presented: 1. It is not safe to go beyond a depth of 16′ feet in this soil, in an attempt to increase the supply of water. 2. The best place to locate a well is near the III Boring. As we go east or north, the salt content increases. In this boring, the total soluble salt content is the lowest, as seen from the comparative table below.

	Total Soluble Salts parts per 100,000 Appearance of water.	Content at 39' depth.
I Bore Trial	57	360
II Bore Trial	50	250
III Bore Trial	41	232
IV Bore Trial	46	390
V Bore Trial	110	280

In addition to this low soluble salt content, magnesium salts are very low in amount, the chloride being found only after a depth of 18 feet is reached. 3. A number of shallow wells, none of them deeper than 15′, would be the best way of providing an adequate supply of water for the college and the best place to locate these wells would be near the spot where the III Boring was made and all the wells could be connected together by a pumping installation.

In addition to the 70 samples from the above boring trials, samples from existing *doruvus*' were drawn in the new area proprosed to be acquired on the north-east side of the students' hostel. In these samples, the chloride content alone was determined, since the number of samples was large and it was felt that a complete analysis need not be taken up unless the chloride content warranted it. It was found that the amount of chlorides was abnormally high in all these samples indicating a correspondingly high salt concentration. It was felt that a boring trial in this area would not lead to the location of good water. The results confirmed further, the findings of the boring trial, namely that as we go farther and farther from the college in a north and an easterly direction, the salt content generally increases.

The presence of magnesium chloride in the Bapatla wells is characteristic. References* to literature show, that near the sea coast, tidal influence even through the soil layer has been known to affect the composition of water sources up to a distance of 15 miles—and it is possible that in Bapatla which is 4 to 5 miles from the sea, a similar

*The examination of waters and water supplies: (Thrush, Beal and Suckling, 5th Edition, by B. V. Suckling, 1944, J. & A. C. Churchill Ltd., London.

influence is exerted the consequence is the presence of magnesium chloride. There seems to be some justification for this for in the several wells examined, it was found that as we go further away from the sea, not only do total soluble salts decrease, but magnesium chloride is very low or completely absent. Amongst nearly 300 samples examined, the best water was found in a disused well in the new area proposed for acquisition for the college farm on the Guntur road. The analysis of that water is given as it is interesting: Calcium bicarbonate—13·72, sodium sulphate—24·10, sodium bicarbonate—4·10, sodium cholride—2 23. Total soluble salts—41·2.

With a total soluble salt content of only 41 parts per 100,000 with no magnesium chloride and very small amounts of sodium chloride, this well is unique amongst those examined in and around Bapatla. It is situated in a "*Pattimannu*" area and about 7 miles from the sea and a mile further off still, is a big drain leading from the Krishna canal. During the rainy months, most of the outlying area gets submerged under water.

Another well within Bapatla town, worth mention amongst those examined is the one in the taluq office compound. This also showed on analysis low total soluble salts (46 parts), low sodium chloride (22 parts), and was completely free from magnesium chloride.

PART II.

While the analytical data outlined above showed the best place to locate a series of wells for college supply and that it is not safe to go beyond a depth of 15 feet it was considered desirable to pursue the investigation and accumulate data, to have an idea of seasonal variations. It was not possible to do this in all the spots examined due to limitations of time, space and equipment in the laboratory. It was decided to concentrate on two chosen water sources within the college compound, draw samples every month and analyse them. For this purpose the hostel well and a pond near the college dairy were selected. The first sample was drawn from these on 24—2—1947 and since then 25 rounds of sampling have been finished up to date, the interval between any two rounds being roughly about a month. Care was taken to draw the samples on the same dates from the two sources.

The analytical data pertaining to these 25 rounds is furnished in appendix II.

From the data it is seen that:—

1. The hostel well water has a higher soluble salt content (130 –140 parts for 100,000) than the dairy pond (about 90 parts).
2. The hostel well water has a higher sodium chloride content (55 to 65 p. p.) than the dairy pond (30 to 45).

3. Calcium bicarbonate is also higher in the hostel well (40—45 p. p.) than the dairy pond (15 p. p. m.)

4. The most characterastic difference however is the complete absence of calcium sulphate and magnesium chloride in the dairy pond while the hostel well contains appreciable amounts of these salts, especially magnesium chloride.

5. Magnesium sulphate is also high in the hostel well water (25 p. p.) while it is either low or absent in some months in the dairy pond.

6. As against this, the dairy pond has appreciable amounts of sodium sulphate, which is absent in the hostel well.

The two sources are within a hundred yards of each other, but show such wide variations. While the hostel well gets periodcally pumped for supplying water to the college, the draw is not so great in the dairy pond, the water from which is taken by pots only, for the use of the dairy shed or for splash irrigation of the plants grown near by. It is possible that the hostel well gets its supply from deeper percolation, while the dairy pond which has a large surface area, gets its percolation water from nearer the surface. This might account for the difference in composition between the two waters.

It is also seen that while there is not much seasonal variation in both the sources, the hostel well water is more or less constant not only in its total soluble salts, but also in its calcium and sodium salts ; on the other hand, the dairy pond is showing a tendency for a rise in concentration. It may be mentioned in passing that it has been the experience in Bapatla, that newly dug wells are sweet and used for drinking purposes, but gradually get saline with lapse of time. In the beginning they get their supply from surface percolation, and when this gets exhausted, a deeper spring is perhaps the source and this is influenced by the proximity to the sea. The dairy pond, which has so far not been used, is passing through a stage, when the salts are gradually increasing and will finally reach a constant figure. If a pump is also installed in the dairy pond, and the draw of water greater than now, this might result sooner. It is proposed to continue the analyses in monthly intervals for several seasons more to elucidate this aspect.

PART III

The work out lined in parts I and II referred mostly to the analysis of well waters either in or in close proximity to the College. The wide variations found within a short distance of each other required further intestigation. The Principal, Sri P. V. Ramaiah, suggested following up

the work with a study of the sand or any geological, strata at the bottom of the wells, in addition to analysing the water. With this object, a number of wells not only in Bapatla but as far away as Chinnaganjam were taken up for study.

Along with the drawing of water samples, samples of soil, or sand or weathered rock, found at the bottom of the well were also drawn for later examination. Below are given the analytical data referring to three well waters drawn from Chinnaganjam.

		Railway Station water supply reservoir.	A doruvu near the outer semaphore reputed to be, good water.	A newly excavated doruvu about 1 mile north of the Railway Station.
Calcium Bicarbonate	...	15·39	12·14	3·62
Sodium Bicarbonate	...	...	...	4·76
Sodium Chloride	...	12·69	9·94	9·48
		28·02	22·08	17·86

All the three wells were found to be extremely good, containing low total soluble salts, low sodium chloride and no magnesium chloride at all.

Chinnaganjam is an important watering station. for all trains on the main line, 25 miles from Bapatla. It is also on the sea coast and it is surprising that the water should be so good. It is however, on a different longitude from Bapatla which is more to the north east. As a matter of fact the sea has receded and Bapatla itself is on a curve of the coast line.

Samples of sand collected from the Chinnaganjam wells have been preserved for later complete chemical and mechanical analysis, but microscopic examination revealed an interesting feature. As in Bapatla no rock was met with in Chinnaganjam at the bottom of the wells, the soil being also sandy. But the sand of Chinnaganjam seen under the microscope, showed *smooth, rounded* and slightly coloured particles. The Bapatla sand particles on the other hand were angular, sharp and jagged and white in colour. The Bapatla sand seems to have been formed by the receding of the sea while the Chinnaganjam sand shows the erosive action of ruuning water. A number of smooth, white flat pebbles collected at the bottom of these wells also shows this. Perhaps there is an underground spring located in the longitude of Chinnaganjam. When time and facilities permit, it is proposed to follow up this work by examining a number of water springs between Chinnaganjam and Bapatla. Included in this study, will be the analysis of waters for irrigation and drainage channels which traverse this area.

To Sri C. R. Sreenivasa Ayyangar the Principal of the College who first suggested this work, and to Sri P. V. Ramiah the present Principal, who has been giving valuable suggestions and guidance during the progress of the work our thanks are due. Our thanks are also due to the other assistants who have been helping us in the analytical portion of the work mentioned in the paper.

APPENDIX I

Depth in feet	Heads of Analysis; per 100,000 (to the nearest integer)								
	Ca $(HCO_3)_2$	Ca SO_4	Mg $(HCO_3)_2$	Mg SO_4	Mg Cl_2	Na HCO_3	Na_2 SO_4	Na Cl	Total
				No. I—Bore Trial					
10	16	12	...	5	6	...	...	9	48
12	16	...	...	...	...	...	16	15	47
14	21	13	...	2	9	...	...	20	65
16	41	15	...	8	17	...	...	57	138
18	40	3	...	19	4	...	...	74	140
20	46	4	...	10	...	...	12	88	160
22	53	17	...	19	21	...	...	90	200
24	54	12	...	39	25	...	...	133	263
26	69	...	4	39	40	...	...	130	282
28	77	10	...	57	35	...	...	141	320
30	75	...	...	67	17	...	...	196	355
				No. II—Bore Trial					
7	39	1	...	...	...	...	...	9	49
9	29	17	...	...	5	...	...	11	62
11	36	10	...	...	9	...	...	13	68
12	43	11	...	...	13	...	...	24	91
14	34	...	14	...	...	...	...	54	102
16	36	...	13	10	4	...	...	27	90
18	53	...	10	26	...	...	...	103	192
20	61	18	...	31	40	...	...	102	252
22	54	32	...	35	47	...	...	116	284
24	54	31	...	31	51	...	...	106	273
26	58	24	...	38	37	...	...	135	292
28	54	18	...	38	56	...	...	112	282
30	49	20	...	15	74	...	..	89	247
				No. III—Bore Trial					
5	28	...	...	...	...	4	...	9	41
6	30	...	...	...	...	4	...	9	43
7	32	...	...	...	...	3	...	9	44
8	22	...	...	...	...	...	...	12	34
9	34	...	...	...	...	...	...	19	53
10	25	...	...	...	...	...	...	18	43

APPENDIX I—*contd.*

Depth in feet	Heads of Analysis; per 100,000 (to the nearest integer)								
	Ca $(HCO_3)_2$	Ca SO_4	Mg $(HCO_3)_2$	Mg SO_4	Mg Cl_2	Na HCO_3	Na_2 SO_4	Na Cl	Total
11	22	...	...	...	...	16	7	44	89
12	24	...	...	...	...	18	12	43	97
13	32	...	...	...	...	13	14	51	110
14	31	...	10	...	...	...	10	55	106
16	44	...	12	20	...	...	8	55	139
18	52	...	9	28	10	...	...	86	185
20	49	...	10	26	10	...	...	89	184
22	52	...	11	27	18	...	...	82	190
24	49	...	17	28	12	...	...	90	196
26	49	...	20	28	7	...	...	95	199
28	50	...	12	32	...	...	21	104	219
30	56	...	8	39	9	...	...	120	232
				No. IV—Bore Trial					
5–7	20	3	...	...	...	...	...	23	46
7–9	20	5	...	...	...	...	...	25	50
9–11	23	...	...	...	...	8	3	25	59
11–13	49	14	...	13	16	...	..	83	175
13–15	36	12	...	13	13	...	...	40	114
15–17	56	21	...	38	28	...	...	70	213
17–19	56	28	...	31	36	...	...	22	173
19–21	56	21	...	28	19	...	...	42	166
21–23	57	...	...	45	...	...	22	60	184
23–25	53	3	...	56	17	...	...	145	274
25–27	42	20	...	48	11	...	...	176	297
27–29	41	17	...	54	15	...	...	203	330
29–30	49	19	...	63	11	...	...	173	315
				No. V—Bore Trial					
5–7	23	...	...	...	...	35	12	12	112
7–9	23	...	...	...	...	34	12	46	115
9–11	27	...	...	...	...	29	12	46	114
11–13	23	...	...	...	...	40	14	46	123
13–15	47	9	...	31	26	...	...	26	139
15–17	56	9	...	43	39	...	...	19	166
17–19	52	7	...	53	11	...	...	59	182
19–21	49	7	...	55	9	...	...	59	179
21–23	52	1	...	68	7	...	...	132	260
23–25	45	14	...	64	11	...	...	122	256
25–27	45	3	...	64	..	...	16	146	274
27–29	46	2	...	74	...	...	14	146	282
29–30	45	...	4	66	...	...	24	139	278

APPENDIX—II

Analysis of water samples from the Hostel Well and the Dairy well
Agricultural College, Bapatla.
Parts per 100,000 (rounded to the nearest integer)

Date of sampling	$Ca (HC_3)_2$		$COSO_4$		$Mg (HCO_3)_2$		$Mg SO_4$		$Mg Cl_2$		$Na_2 SO_4$		Na Cl		Total.	
	H.W.	D.W.	H.W.	D.W.	H.W.	D.W.	H.W.	D.W.	H.W.	D.W.	H.W.	D.W.	H.W,	D.W.	H.W	D.W.
24—2—47	44	9	2	absent	absent	13	16	2	11	absent	absent	..	71	27	144	51
2—4—47	48	9	6	,,	,,	11	9	..	12	,,	,,	11	63	35	138	86
1—5—47	39	11	7	,,	,,	13	11	...	21	,,	,,	9	49	27	120	66
2—6—47	57	20	...	,,	,,	13	13	...	10	,,	,,	11	57	59	137	133
4—7—47	35	14	2	,,	,,	17	10	...	4	,,	,,	12	56	45	107	88
22—8—47	43	14	...	,,	,,	5	5	...	...	,,	,,	15	81	39	129	73
29—9—47	49	20	8	,,	,,	3	16	14	13	,,	,,	6	80	32	166	75
27—10—47	37	20	14	,,	,,	3	7	14	18	,,	,,	6	62	32	138	75
30—11—47	35	20	16	,,	,,	11	3	13	26	,,	,,	9	49	52	129	105
5—12—47	36	21	15	,,	,,	2	5	17	21	,,	,,	...	56	40	133	80
20—1—48	50	17	7	,,	,,	14	11	11	13	,,	,,	9	46	39	127	90
23—2—48	53	18	10	,,	,,	6	3	4	21	,,	,,	18	63	42	150	88
19—4—48	47	15	6	,,	,,	4	16	11	2	,,	,,	10	68	51	139	91
21—5—48	45	8	11	,,	,,	...	8	17	12	,,	,,	11	56	31	132	67
30—6—48	55	17	5	,,	,,	4	38	3	...	,,	,,	30	88	76	186	130
5—8—48	49	16	10	,,	,,	..	...	...	...	,,	,,	10	77	57	136	83
9—9—48	36	26	18	,,	,,	...	...	...	...	,,	,,	23	68	62	122	118
9—10—48	45	21	10	,,	,,	...	14	...	15	,,	,,	21	63	52	147	116
2—11—48	42	14	6	,,	,,	...	12	...	11	,,	,,	22	63	55	134	105
2—12—48	39	17	1	,,	,,	...	11	...	20	,,	,,	22	51	40	132	98
31—12—48	45	22	6	,,	,,	15	28	...	...	,,	,,	39	74	44	153	121
31—1—49	40	14	4	,,	,,	22	17	7	7	,,	,,	14	61	50	129	107
28—2—49	42	13	6	,,	,,	24	18	...	43	,,	,,	17	18	54	127	98
31—3—49	43	11	10	,,	,,	29	21	...	9	,,	,,	23	70	83	153	146
2—5—49	38	11	7	,,	,,	31	16	...	7	,,	,,	24	37	73	105	143

"How facts flow to farmers in U. S. A."*

By

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I. **The role of the universities:** The Universities in North America are important centres of activity for both agricultural research and the transmission of results of research to the farmer. Between the farmer and the university, there is a two-way traffic, with the farmer taking his problems to the university and the university contacting the farmer with the solution to his problems. The College of Agriculture, of U. S. universities is organised with three main functions: (1) Resident instruction in agriculture. (2) Experiment station and research work. (3) Extension service, which is the propaganda section as we call it in India. Resident instruction provides for major specialisation in agriculture and in its numerous allied fields. The Experiment stations are the means through which many contributions to a more productive and pleasant farm life are made. The Extension service, including its staff of county agricultural agents, home extension agents and club agents, which are their equivalents of our agricultural demonstrators, disseminates the information derived from the Experimental stations and College laboratories.

(1) *Resident instruction*: In the Michigan State College, which is the oldest agricultural college in the U. S. A., there were in 1948 1,085 students working for their Bachelors degree in agriculture, 190 postgraduate students and 743 students undergoing short courses. These short courses form an important part of the college activity, being designed to give every type of farmer or his sons and daughters an opportunity to keep abreast of the latest developments in his type of farming. They provide a variety of courses running to 200 and more, to suit every type and branch of farming, lasting from a few days to two years' duration, according to the needs of the student or farmer.

(2) *Research*: There is no need to emphasise here the quality and quantity of agricultural research in U. S. A. Given the same equipment and facilities as exist in the U. S. A., agricultural research workers in India can also produce as much results as American scientists and can place India definitely on a position of prestige in research. One other reason for this attainment of research is the spirit of camaraderie that exists between the American research worker and the farmer. The research worker in American U iversities is on such close terms with the farmers with whom he deals that he keeps his researches abreast with the farmers' problems. This is helped not only by the direct contact of the research worker with the farmer but also by an intimate liaison with the Extension service which forms a part of the University.

* Paper read at the 32nd College Day and Conference.

(3) *Extension Service or Propaganda*: The extension work in many states covers both Agriculture and Home Economics and is a co-operative enterprise carried on by the universities, the United States Department of Agriculture and the countries of the State (which are comparable to the districts of our province) but entirely under the supervision of the University. This Extension Service reaches every county and township (which is comparable to our villages) through the county agents who are *specialists in agriculture, home economics* and *youth training*. In U. S. A., the farmers' home is treated as an economic unit and the farmers' children as the future generation of scientific farmers. It is the corner stone of the agricultural propaganda in America that the farmer and his home must be planned and managed in harmony to produce effective results, without which agricultural improvements will never get "down to the earth". This is the reason why there is so much of home economics in every American university, always allied with agriculture.

Further, specialists and demonstration agents can achieve little by themselves unless there is a local rural leadership to co-operate and this is the basic reason for the county agents also to be specialists in *youth training*. In fact, the farmers and home-makers are mainly reached by the specialists and demonstration agents through these local leaders. In Michigan, in 1948, for instance, leadership training meetings numbered nearly 2,000 with more than 30,000 local leaders taking part and carrying information back to their townships.

(4) *Work of some of the departments in the College of Agriculture*: A few instances may be mentioned here of the types of work carried on by the research departments in the universities, to see that the farmer gets what he needs in time. Every year the farm management department analyses hundreds of farm business records to advise the farmers on the economic trends of farming. In 1944, anticipating a back-to-the-land movement following the war, this department in the Michigan State College, provided information to guide ex-servicemen, industrial workers, and others, considering farming as a vocation. The Dairy Department in the same college developed a programme of state-wide artificial insemination of cattle, in co-operation with the Michigan Artificial Breeders' Association and in the very first year, 1945, 20,000 cows were successfully inseminated. The Agricultural Engineering Department of the same college introduced recently a mechanical sugar-beet harvesting equipment, and what can perhaps be described as a field-size "Vacuum Sweeper" for harvesting seeds and seed-heads of crops that lie on the ground, by sucking them up with the help of a motor-driven fan and by collecting them in a large canvas bag for subsequent threshing and cleaning. One of the usual features of the Agricultural Engineering Department is the constant remodelling of farmers' homes.

(5) *The Public Relations Department*: Here we come into a characteristic feature of America, of specialisation in publicity, based on the principle that the people should know as much as possible, to make them efficient farmers, and citizens. Each university has a public relations department whose duty is to supervise and turn out publications of all kinds, from the most scientific, to the most popular so as to suit all types of readers. This department also makes the best use of audio-visual aids to convey information and takes every care of the visitors and invites visitors who are interested. Such a department in the university does very useful work for the agricultural college and an evidence of the intensity of work are the numerous leaflets, bulletins and magazines, that are sent out regularly every now and then, and with which the members of the Madras Agricultural Department are so familiar. In 1948 at the Michigan State College, 112 new Extension Service Publications were produced and nearly a million copies distributed from the Bulletin office. More than 1,300 different information stores were released to Press and Radio outlet during the year. Manning this department are personnel highly trained in the various branches of literary work, printing, publishing, photography, audio-visual aids etc.

(6) *University contacts with the farmers*: The universities with agricultural colleges are so anxious that the farmers should visit their agricultural departments and see what they are doing, that they organise annual events for the farmers. At the Michigan State College, I had the privilege of attending a Farmers' Week in 1948, conducted by the university, which was attended by 30,000 farmers; and which gave the rural people of Michigan short courses in new ideas of farming and home making. There was an Annual Farmers' Day and 4-H Club show in August, which attracted whole families of farmers.

II. **The role of the Government**: (a) *The State Government*: While the work of the State Universities detailed before is the concern of the State Government, each state has also the State Department of Agriculture and the State Department of Conservation. With the help of the State Soil Conservation Committee, ways and means are found of taking to the farmer's door, demonstration and information on soil conservation. Besides this, many states have Land Use and Zoning Acts to prevent unwise use of the land, especially lands of low fertility.

(b) *The Federal Government*: The farmer is so important to the Nation as a whole that his problems are of national concern to the American Government. The agencies of the U. S. Federal Government for helping the farmers are too numerous to mention but just a few important aspects of this work may be given. One of the most important features of Federal Service to the farmer is that whatever the type of help given to the farmer, it is almost invariably accompanied by

recommendations for improvements, such as greater emphasis on appraisal, farm management, auditing, statistics, research and information and education services to the farmer.

(1) *The U. S. Department of Agriculture*: This department is the largest agency of the Federal Government, having numerous activities, some of which are listed below:

(a) *The Bureau of Plant Industry, Soils and Agricultural Engineering, Beltsville, Maryland*: This is the most important branch of U. S. Department of Agriculture, with field locations for research spread all over the states and in ten Latin American countries, and co-operating with State Experiment Stations of 44 states, and having a 14,000-acre agricultural centre. It is significant that included in its four main lines of work is "Designing farmhouses and other farm buildings that make for comfortable living and profitable farming". The Burean has also one of the best publicity departments of U. S. A., issuing leaflets and bulletins in thousands, taking care of innumerable visitors and specialising in visual aids for conveying information to farmers.

(b) *Bureau of Agricultural Economics*: This is a federal research agency of the U. S. Department of Agriculture, to collect, analyse and interpret production, economic and social information affecting agriculture; to act as adviser to the Secretary of Agriculture and to agricultural committees on national policies and legislation. The staff is located in Washington D. C., and in each state, while the agricultural specialists are at the agricultural colleges. It prepares many hundred publications each year, including special reports on commodities, research bulletins, a monthly check list of publications, all used by trade, farm organisations and the agricultural colleges.

(c) *U. S. D. A. Market News Service*: This agency collects and reports information on the volume and prices of livestock and agricultural produce and prepares reports for distribution to press, radio and to individuals.

(2) *U. S. Soil Conservation Service*, furnishes help and information regarding the soil practices, contour farming and strip cropping etc.

(3) *The Rural Electrification Administration*, another agency of the Federal Government, aims to bring more and more farms every year under electrification and informs the farmer of all the progressive uses that electricity could be put to in a farm.

(4) *The Tennessee Valley Authority*. What the T. V. A. has done to revitalise the American farmer with all that is modern in research, is a story that would belong to a seperate chapter. But, it is of importance

to mention here, about the test-demonstration farms used as an educational device, at the Tennessee Valley region for achieving the agricultural development of that region. In June, 1946, there were 38,800 of them in active operation. Through the test-demonstration farms, practical farmers can learn through their own action and by observation, the methods and benefits of proper application of soil minerals and of altered farm practices and farm management. In this way, the neighbours of test-demonstration farmers can see actual results. The demonstrations are of two types. One is the "Unit" test demonstration farm, in which individual farmers, usually selected by their neighbours, test and report on results of new methods in farming operation which are planned by the farmer with the help of his county agent. The other is the "area" demonstration in which entire farming communities participate. In such communities, agricultural developments becomes a co-operative effort and leads usually to a quickening of the community spirit and community life. These test demonstration farms have been copied in several states of the nation, by Experimental Stations and Extension Services so that today three million acres are under test demonstration farms. Such test demonstration farms would be very useful under Indian conditions also, as they produce a new pattern of farming which develops and utilises most effectively the natural resources of water, soil and crops, the capital resources such as buildings, fences, power, machinery, equipment; the farm family resources such as labour, skills and knowledge; and community resources such as marketing, distribution and processing facilities, churches and schools. This development is essential in freeing the farmer from the limitations of poor land, lack of power, machinery and livestock, inefficient agricultural practices, and limited skills and a narrow outlook and in opening the way to an effective democratic way of life on the farm and in the farm community.

III. **The role of the Press and the Radio**: While the national magazines and newspapers continuously feature topics for the farmer, the Community Press, as it is called, is the most influential in getting to the farmer the latest in farming developments. Every township or a small group of township run their own dailies, featuring news for the farmer. Besides this, papers like the Hoard's Dairymen at Wisconsin, play an important role in educating the farmer. The Hoard's Dairymen has a wide national circulation and has an editorial staff of nine specialists who seek the latest findings of the agricultural colleges. The managing editor of the Hoard's Dairyman, Mr. A. J. Glover, runs a practical 200-acre dairy farm, just to be sure of what he says in his magazine. Besides these are the numerous agricultural monthlies, run on popular lines. The radio also plays its tremendous part, and many of the universities with agricultural colleges own broadcasting stations from which are beamed forth information for the agriculturists and warnings about weather, pests and diseases, day in and day out.

IV. **The role of the 4 H-Club**: This is a well-known club for the sons and daughters of farmers, who are to be trained as the future farmers of America. The movement is one of the great contributory causes of the continued prosperity of the American agriculturist. The number of projects that are tackled by these youngsters in raising the best crops, fruits, vegetables, poultry and livestock under competition, with the guidance of the county agents and the enthusiasm with which the boys and girls take to these projects is astounding. What happens by way of introduction of the latest methods of agriculture to the children of the farmer cannot be easily ignored by the farmer himself. The 4 H-Club has contributed so much to the progressiveness of the farmers that the County Boards of Michigan last year, voted a total of 300,000 dollars (10 lakhs of rupees) to the programmes of the 4 H-Club. A great youth movement, it reached 60,000 boys and girls from ten to twentyone years of age in the one state of Michigan alone. The Agricultural Extension Service, is closely knit with the 4 H-Club.

V. **The role of private enterprise**: There are numerous large industries depending upon agriculture as its raw material and in all these cases, the industries establish special departments of agricultural research to help the farmers. The Gorber Products Company, the largest baby food plant in the world situated at Fremont in Michigan, is an example. This company processes a great variety of fruits, vegetables, soups, meats etc., for children and it has a department of agricultural research to obtain quality products. The International Harvester Co., which manufactures and distributes a wide variety of farm machinery in the U. S. and foreign markets, uses literature, films, exhibits, and demonstrations not only to sell their products but also to increase farm efficiency and farm income and to save labour and energy in form operations. Swift and Co., in Chicago, the largest meat packing concern in the world has one of the largest departments of agricultural research for any private company in the world and by direct contact with their farmers, see to it that the results of research are assimilated into their practices. The Dow Chemical Company, one of the largest of its kind, publishes magazines for farmers to keep them informed of the latest developments in the application of plant hormones and chemicals to agriculture. Kellogg, the manufacturer of the famous Kellogg's Corn Flakes and breakfast cereals has established what is known as the Kellogg Foundation, worth nearly 50 million dollars, most of which goes towards increasing the welfare and efficiency of the farmer. In addition to these, there are several private institutions, entirely supported by private funds for research in agriculture and plant sciences and with an organisation to see that the results actually reach the farmer. The Boyce Thompson Institute at Yonkers, New York, with Dr. Zimmerman, the wizard of plant hormones, is a great private institution whose contribution to American agriculture is significant and very widely known.

VI. **The role of the farmer:** (a) *Farmers' organisations*: The role that the farmer himself plays in keeping abreast of the results of agricultural research is almost incredible. The organisational capacity of the American farmer, in the interest of his group is astonishing. In Michigan alone, which is comparable to a province in India, there are 23 Livestock Associations, 6 Dairy Cattle Associations, 9 Dairy Produce Organisations, 10 Poultry and Rabbit Organisations, 4 Farm Crops Associations, 5 Agricultural Engineering Organisations, 4 Muck Farmers' Associations, 1 Farm Management Association, 1 Soil Conservation Association, 12 Horticultural and Floricultural Organisations, and 18 Agricultural Economics Organisations, making a total of 96 different agricultural organisations to take care of different interests. This is apart from 2 Forestry Associations and 6 Veterinary Medical Associations which are treated very often in America as part of Agriculture. The aim of all these organisations, is to get the best out of research in their fields, from whatever source it is available, so as to keep continuously modern and efficient in production and marketing methods. They invite speakers to their groups, welcome demonstrations in their fields, organise trips for their members to colleges, research centres and private farms run on scientific lines, hold exhibitions and publish their own magazines or information bulletins, pool their resources to persuade the government to enact beneficial laws in times of need or to cancel enactments that would harm their industry.

Of all the agricultural organisations, the general trend of the co-operatives is the most encouraging feature of American agriculture. The best examples of such co-operatives are the California Fruit Exchange (deciduous fruits) and California Fruit-Growers' Exchange (citrus). These exchanges are grower-owned, co-operative marketing organisations, and they own and operate numerous packing houses, located in every fruit district of California, and several by-product industries and they bring to the growers the latest in methods of production.

At the national level, there are organisations to take care of the interests of the whole group of farmers of the nation. The American Farm Bureau Federations was organised in 1919 to "represent the business, economic, social and educational interests of the farmers of the nation and to develop agriculture". It publishes a magazine called "Nation's Agriculture". It has been responsible for many legislative measures of the Congress to benefit the farmer. The National Council of Farmer Co-operatives is a public relation and legislative agency for the farm co-operatives and prepares materials for distribution to members as "Washington Situation", a weekly release, and represents members at legislative hearings as a voice of organised agriculture.

The farmers' aptitude for research and his promptness in application of results : Most of the American farmers have an interest in research and this is one of the contributory causes to American efficiency in agriculture. They are themselves often trying and evolving new practices and forcing the Experiment Stations to keep ahead of them. The California Citrus Industry is a tribute to the pioneering spirit of the citrus growers of California. The famous Henry Wallace is a practical farmer of Iowa and was one of the persons responsible for the development of Hybrid Corn, which has revolutionised agriculture in the mid-west regions of the U. S. A. The American farmers are also quick to seek and adopt results of research. Artificial insemination for cattle breeding, the general use of chemicals and plant hormones, the spraying and dusting for pests and diseases by aeroplane and the highly mechanised agriculture are all examples of the receptivity or the American farmer to progressive ideas.

What we can do in India : Briefly, the reasons for the very successful education of the American farmer, are the following :—

(1) Between the research worker and the farmer, there is a comradeship, made possible because of the high educational level of the American farmer.

(2) The American policy of agricultural research reaching the farmer is to treat the farmers' family as an economic unit on the basis that only if the family is prosperous can there be a question of the farmer carrying out improvements.

(3) The American policy is not to be satisfied with the efficiency of the present generation of farmers but to ensure also that the future generations keep up their efficiency with the times.

(4) There is a conviction that the Extension Service (i.e. Propaganda division) cannot by themselves achieve much, unless there is local leadership to assist. Hence the American emphasis on leadership training as the cornerstone of Extension policy.

(5) The Press in America has realised the importance of the farmer. The Community press to serve the farmers is a feature of American agriculture.

(6) The Radio is equally of service to the farmer by keeping him posted with up-to-the-minute developments.

(7) The Private Industries which thrive on agriculture in America attempt to return the debt they owe to the farmer.

(8) The American farmer is well-educated, modern and well-organised, so that he can produce and market efficiently.

(9) Lastly, the Americans are experts in publicity and they leave no stone unturned to see that the information they have, reach the farmer. In this, the latest methods of visual aids are a great feature.

From all this it is evident that we cannot entirely duplicate the results of America in India, because the Indian farmer is not on the same educational level, to be receptive to developments to the extent that we would wish, and to organise himself to develop as a group. Education and organisation of the farmers should be the keystone of our agricultural policy. That a whole generation of farmers cannot be made overnight to read and write is not a matter of despair. Audio-visual aids come to our rescue and if these aids are properly used and if men with ideas are utilised to develop the material required in script and presentation, there is a tremendous possibility. Besides this, the Indian tradition is so full of village dramas, rural folk songs and dances that we can utilise them to the advantage of the former. As far as organisation of the farmer is concerned, training of local leaders becomes a matter of utmost importance —leaders who are trained to be scientific farmers, and who are respected by the local community.

Deficiencies of minor elements responsible for diseases of crop plants in this province *

By

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Crop plants remove considerable amounts of mineral nutrients from the soil during their life. A small percentage of these may be returned to the soil by the disintegration of those parts left in the soil. But the major proportion contained in stem, leaves, fruits and seeds does not come back at least to the same place. Consequently replenishment of the loss is necessary. For this purpose manures have to be applied to the cropped areas. Knowledge of the nutritional requirements of plants have undergone change in recent years. At one time it was thought that the plants were in need of only ten essential elements for growth. Recent work especially during the last three decades has however resulted in the development of our knowledge of the part ~~part~~ played by various other elements in the life of the plants and has led to the addition of more elements under this category. These later additions are usually termed as "minor elements" "trace element" or "micronutrients" and have been found to be equally essential though they are required only in extremely small quantities. Though the role of these elements fall within the realm of physiological studies, the absence or deficiencies of these elements lead to the development of pathological symptoms of crop plants

* Paper read at the 32nd College Day and Conference.

and these are of considerable interest to the plant pathologist. Furthermore there is more information of the pathological aspect of these trace elements than their physiological functions.

In our province a certain amount of investigation of the pathological aspect of some of these elements has been made by the mycology section and the results are included hereunder.

One of the trace elements whose deficiency has been exhibited by disease symptoms in plants is boron. During the World War II intensive cultivation of vegetables was undertaken on the Nilgiris for the benefit of the army. Extensive areas were under turnip, beet root, cauliflower and cabbage. The turnips, beet roots and cauliflowers grown in some localities near Ootacamund developed certain pathological symptoms. The core of the root in turnip was soft and presented a discoloured water-soaked appearance (water core) instead of being white and hard. In beets the crown was often found rotten, blackened and the young leaves at the top were also involved. The cauliflowers in some fields did not develop the normal creamy curd but had poor flowers of varying shades of brown. Pathogenic organisms were not present in the affected portions. Similar symptoms on these crops have been described from other countries as being caused by boron deficiency. The only way to test this was by supplying the deficiency. With the co-operation of one of the leading ryots of Ootacamund, field experiments were conducted for over two seasons, for the control of water core of turnips. Boron was applied to the soil in the form of boric acid a few days before sowing at the rate of five, ten, fifteen and twenty pounds per acre. Spray inoculation of a 0·2 percent solution of boric acid on the foliage was also tried. An examination of the tubers from the various plots showed that all the treated plots had very little or no symptoms of the disease and that spray application was as effective as application to the soil. Thus it was proved that boron deficiency was responsible for the symptoms of water core of turnips. Based on these experiments the ryot was advised to broadcast 5 pounds of boric acid per acre. It is also concluded that the pathological symptoms observed on beet roots and cauliflower must be due to the same cause, and boric acid application will be beneficial.

Boron deficiency affects growth of many other crops also. Excess of boron is however toxic to plants and this has to be borne in mind in recommending the dosage of the element to be applied.

Zinc is another minor element whose deficiency in the soil or non-availability to the plant is evident in many parts of the province. Orange trees in several districts of the plains exhibit symptoms of zinc deficiency. The growth of the tree is arrested. The leaves develop yellow blotches between the veins presenting a characteristic mottled appearance. The leaves become progressively smaller; fruits are produced and in course of time the tree deteriorates and falls a prey to other pathogens.

There are two ways of supplying this deficiency, either by application of zinc sulphate to the soil or by the spray application on the foliage. Addition of zinc sulphate to the soil was done by placing it in holes 9 inches deep all round the tree or by broadcasting the salt over the soil round the trees and working it in. Both these methods failed to produce any response in the trees. The spray application was next tried. The composition of the spray fluid was varied according to the intensity of symptoms. In trees which had initial stages of deficiency symptoms zinc sulphate-lime mixture of the formula of 5 – 2½-100 was used and in more severe chronic instances the formula 10 – 5-100 was followed. Zinc sulphate was dissolved in water in one vessel. In another bigger vessel the lime was slaked and later diluted with the required quantity of water. The zinc sulphate solution was poured into the lime solution and stirred. The resulting mixture was sprayed on the foliage. The best period for spraying is when the trees are putting forth new flush of leaves. Two applications are necessary in a year and these can be adjusted with reference to the flushing period in each locality. It is better not to spray when the trees are in flower. Experience in America and in our Province has shown that there is no harm when the trees with fruits on are sprayed provided the mixture is correctly prepared (neutralised). The response is much quicker when the spray is made on young foliage than on old ones. Application of large quantities of farm yard manure in addition to the spray will also be beneficial. Zinc salts may be present in the soil but do not become available to the plants and that is the reason why soil applications do not produce any response. The results of these experiments have been given wide publicity and several orange growers are regularly spraying the trees with zinc sulphate. The department had arranged to distribute over 5 tons of zinc sulphate in 1947 and larger amounts are being used at present.

Another minor element whose deficiency has been found to produce pathological symptoms is copper. Citrus plants readily exhibit the deficiency of this element. The disease known as 'Exanthema' or 'one form of die back' is due to this. In the initial stages of copper deficiency the young branches are frequently angular and 'S' shaped with multiple buds instead of being round with usually one bud as in normal plants. In acute stages the twigs begin to die back and gum pockets develop at the leaf bases. The branches may be covered with brown gummy excrescences and ultimately defoliation takes place. The rind of the fruit also may exhibit hard brown excrescenses.

Spraying the trees with Bordeaux mixture has resulted in marked response and the disappearance of the symptoms. Bordeaux mixture is sprayed on orange trees for protection against several diseases and this treatment serves also for making good the copper deficiency. Copper sulphate can be applied to the soil also with good effect about half to two

pounds per tree being used either separately or mixed with other fertilizers. It is common experience in many orange gardens that by spraying Bordeaux mixture the production has been increased even in the absence of fungal diseases. It should however be mentioned that the "die-back" caused by lack of copper should not be confused with the one caused by other causes like root damage, shallow soil over hard pan, poor drainage, over irrigation etc.

For some years past a decline of orange trees has been prevalent in the submontane tracts of Shevaroys, Kotagiri and Coorg. In Kukal and Shevroys, mottling and chlorosis of the leaves become apparent and gradual defoliation results. At first it was thought that this might be due to deficiencies of zinc or iron. Experiments were conducted at Yercaud to note the effect of spraying the foliage with zinc sulphate, iron, sulphate and manganese sulphate individully and in combination. But there was very little response.

In Kukal valley also it was surmised that the trees were not getting all the nutrient requirements. The soil from the base of the affected and apparently healthy trees were analysed with the help of the Government Agricultural Chemist. The figures showed that the soil in the neighbourhood of the diseased trees had less of phosphorous. The response from the application of this manure was reported to be incomplete.

It is now known that diagnostic soil analyses for trace elements have been little developed. Visual symptoms of mineral deficiencies exhibited by plants especially orange, sometimes overlap and it is sometimes difficult to state what particular element is wanting from these symptoms. In such cases one has to try cultivation of indicator plants or resort to plant analysis. The latter method has been recognised as a quicker and reliable method and in the present day the composition of the plant tissues as revealed by plant analysis is known to give a correct picture of the nutritional status of the plants. The analysis of the plant material can be made either by the usual time-consuming laboratory method or by the spectographic method.

It was thought that the spectographic analyses of leaf samples of equal age from the diseased and healthy plants from Kukal may give a correct picture of the situation. With this idea Dr. Patwardhan, Director of the Nutrition Research Laboratories, Coonoor was approached to extend his co-operation as he was in possessions of a spectrograph. He readily consented to give all help.

Representative samples of the leaves were taken from the garden of Mr. N. B. Athrey of Kodeneri Estate and he was very enthusiastic in

rendering all help in solving the problem. With the kind help of the Government Agricultural Chemist the samples were converted into ash and taken to Coonoor for the analysis. Dr. De the assistant chemist, helped in the analysis. Several readings were made. It was clear from the spectrograph that the leaves from diseased plants had deficiencies of several elements when compared to healthy ones. Zinc was absent in all specimens. The leaves from affected trees exhibited deficiency of phosphorous, magnesium, manganese and boron whereas no differences could be made out between the two with regard to calcium and iron.

It is clear from the analysis of the leaves that the trees are lacking in several nutrients. There is agreement between the soil and leaf analyses in the matter of phosphorus. But the deficiencies of manganese, boron, magnesium and zinc (in all cases) which have been revealed by the leaf analysis could not be easily made out in soil analysis. Furthermore the minerals may be present in the soil but may not be available to the trees. Citrus trees are known to grow well at pH 7 but very often the nutrient substances do not become available to the plants from the soil at this reaction. The soil at Kodeneri estate was found to have a reaction in the neighborhood of pH 7. Moreover lack of boron has been reported to inhibit absorption of phosphates from the soil. So it is quite possible that the trees are not able to obtain their requirements from the soil due to these causes.

In Florida where deficiencies of various elements have been observed in orange gardens a new technique is being employed for replenishment of the nutrients, i.e., by spraying a combination mixture of phosphorus, potassium, maganesium, manganese, boron etc., instead of applying these to the soil for quick response. It has been decided to try this method at Kukal. Mr. Athrey has agreed to place his garden at our disposal for the conduct of these experiments and we thank him for it.

The usefulness of leaf analysis in determining the nutritional requirements of crop plants is brought out by these experiments. This method of tackling some of the diseases has been attempted for the first time in this province not only in the case of orange but also in the case arecanut, A spectrograph however is essential for this type of work as one cannot be always troubling other institutions for this. I understand that sanction has recently been accorded for purchasing one for this institute. Various undiagnosed troubles without any associated pathogens occur in many crop plants and fruit trees e.g., areca, orange, plums, vegetables etc. The analyses of plant parts may often help in solving some of these problems and a quick and efficient method of doing this is by the spectrographic analysis.

Snmmary. Several pathlogical symptoms caused by deficiencies of minor elements have been observed in this province. Boron deficiency causes water core of turnips and crown rot of beets on the Nilgiris. Mottling of orange leaves due to deficiency of zinc is prevalent in many districts. 'Exanthema' of citrus is caused by copper deficiency, Methods of supplying these deficiencies are described.

Recently a decline of oranges in Kotagiri, Yercaud and other hilly districts has been attributed to deficiencies of several elements including zinc, manganese and boron. This was revealed by spectrographic analysis of plant tissues with a view to obtain a correct estimate of the nutritional status of the plants is stressed.

Gleanings

The peasant and the commisar. An analysis of Russian agricultural policy: For 32 years Russia has been attempting to convert agriculture into an industry on the same lines as the heavy industries. In the plan, control of all farm production was to be centered in Moscow. Workers were to be regimented in the same way as factory hands and miners. The experiment has not succeeded even to the small extent achieved in other industries. According to the "Soviet Encyclopaedia", Lenin, in 1919, wanted to encourage the small farmers to join co-operatives, i.e. groups in farmers help each other by lending implements, machinery and (sometimes) workers. Most small farmers had no objection to this scheme; it helped them by opening up marketing co-operatives as well. Afterwards, if the plan worked, they were to be plunged into collectivisation (i.e. communisation in which the State owns all implements, equipment and cattle). This was known as "Lenin's Co-operative Plan". Its ultimate object, however, was not "co-operation" as such, but the complete submerging of agriculture into the Soviet economic plan. Large landowners had been liquidated, the Kulaks (independent farm owners) were necessary for the time, because of their experience. Peasants, who formed the major part of the producing farmers, had to be encouraged.

Stalin impatient: Stalin, on the other hand, was more impatient. In an essay "Problems of Leninism" written in 1926 he discussed an alliance between the labouring masses and the peasantry, and wrote: "This special form of alliance consists in that the guiding force of this alliance is the proletariat. This special form of alliance consists in that the leader of the State, the leader in the system of the dictatorship of the proletariat, is one party .... the party of the Communists, which does not and cannot share that leadership with other parties. In fact, the alliance is of the nature of the relationship between officer and man". The Russian peasantry of 1926 was, therefore, in the position of having been manoevred into bringing in the new "officers" to replace the old landlords. The main difference was that the "officers" were controlled by the central Party in Moscow. The fifteenth Party Congress in December 1927 adopted a resolution for "positive measures to be taken to collectivise peasant farming". These measures included the abolition of the Kulaks and controlling of agriculture by thousands of bureaucrats drawn from the proletariat. By November 1929, more than 25,000 city workers had been sent to the country to organise farms on Stalinist lines. Their duties were political but they became virtually "bosses of the peasantry".

In December of that year Stalin delivered a speech at the "Conference of Marxist Students". In it he said: We have passed on to a policy of eliminating the Kulaks as a class. In this way the independent farmer was to follow the large landowner into "liquidation". The decree to put this into effect was published in January 1930. It provided for the expulsion of the Kulaks from their territories and the confiscation of their houses, cattle and machinery. In that winter alone, 500,000 Kulaks were exiled — many of them to far Eastern Siberia where they worked as slave-labourers in the mines or in the lumber camps. During the following two years, that is, until 1932, a total of 2,000,000 Kulaks and better class peasants, followed the same route to the death camps.

In this way agriculture was denuded of its most efficient members. The remainder were inefficient and, therefore, prepared to fit in with the government scheme of full collectivisation. Controlled by the bureaucrats, they failed to produce sufficient food for the winter 1932-33. A famine which was most severe in the Ukraine and in Southern Russia, was the direct result.

"Capitalistic" concesssions: The Kremlin, realising this, was forced to make some major concessions. In the towns, free markets for farm produce were re-introduced. Collective forms as a whole, and individual farmers, were allowed to market any grain left over after they had handed over their state quota. The delivery of quotas was amended. The Kremlin had, therefore, been forced to retreat a little towards a state of "capitalism" in production and trade. It had, in fact, admitted the failure of the attempt to impose the Stalinist policy on farming. That was in 1935 ;but the position is the same today. The peasantry, although collectivised to a considerable extent, is still far behind the heavey and other industries in "communisation". The farmers, however, still operate under bureaucracy with control centralized in Moscow.

The inefficiency of the bureaucrats and the apathy of the farm workers have prevented any real progress. In fact, comparing the small improvement in output with that achieved by modern methods in other countries the Soviet's 30 years of experiments can be considered a failure. In Great Britain the agricultural output for 1948 is three times that of 1938.

In some parts of the Soviet Union, noticeably in the Ukraine, there are collective farms which have been a success. These form a "shop window". Well cultivated land, comfortable houses, tractors and other agricultural machinery, and well-fed farmers do useful service in impressing foreign visitors; the latter are never allowed to get a glimpse of farms that would give a true picture of the general state of Soviet agriculture.

The same propaganda methods are used in other industries and undertakings. In the Dalstroy area in far Eastern Siberia, for instance, the capital, Magadan, is merely a facade behind which nearly a million slave labourers die a slow death. In the "corrective-labour" camps near Moscow the "educational facilities" are demonstrated. These, too, hide the brutality and inhumanity of the M. V. D. (secret police) system. The collective farms in the Ukraine and Southern Russia are momentoes of the 2,000,000 liquidated Kulaks and peasants. Like Stalin's statement in January 1933 they are the beautiful lies behind which the bureaucrat-ridden peasants plod their weary way (British Information Services).

Crop and Trade Reports

Statistics — Agricultural — Cotton — Additional forecast report 1948 — 49. The area under Cotton in the Madras Province in 1948—49 is estimated at 1,500,800 acres as against 1,360,900 acres estimated for the corresponding period of the previous year. The present estimate for the Province represents an increase of 19·0% as compared with the finally recorded area of 1,307,565 acres in 1947—48. The increase in area in the current year as compared with the previous year occurs in all the districts except East Godavari, South Arcot and Malabar where there is a slight decrease. The increase is marked in the districts of Guntur, Cuddapah, Kurnool, Salem, Coimbatore Tiruchirapalli and is due mainly to the increase in demand for cotton. The main or first picking of cotton is over in all the districts. The yield per acre is estimated to be normal in East Godavari, West Godavari, Krishna, Guntur, Malabar and South Kanara and below the normal in the other districts of the province. The crop had a set back due to insufficient rainfall in Guntur, Anantapur, Cuddapah, North Arcot and Salem districts. The crop was also affected to some extent in parts of Bellary and Anantapur by attack of insect pests. The seasonal factor for the province as a whole works out to 88% of the average for both the irrigated and unirrigated crop, the corresponding figure according to the Season and Crop Report for 1947—48 being 82 percent. On this basis total yield works out to 341, 500 bales of 392 lb. in lint as against 272, 732 bales of 392 lb. in lint estimated in the Season and Crop Report of the previous year, representing an increase of 25·2 per cent. 81,300 acres are estimated as standing on the ground for Kar : or second pickings in the Central and Southern Districts. The yield per acre is expected to be below the normal in these districts and the total yield from the Kar or second pickings is estimated at 22,100 bales of 392 lb. in lint.

Statistics — Crop — Sugarcane — 1949 — 50 Intermediate condition report. The sugarcane crop in Guntur is reported to have been affected to some extent by heavy rains. In Bellary, the crop has been affected to some extent for want of adequate supplies of chemical fertilisers in time. The condition of the crop is reported to be generally satisfactory in all the other districts of the Province. The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) on 10th September 1949 was Rs. 24—11—0 in Adoni and Cuddalore, Rs. 24—0—0 in Erode, Rs. 24—4—0 in Coimbatore, Rs. 23—8—0 in Tiruchirapalli and Mangalore, Rs. 23—0—0 in Vellore, Rs. 22—10—0 in Bellary, Rs. 21—0—0 in Visakhapatnam, Rs. 20—15—0 in Chittoor, Rs. 20—9—0 in Kakinada, Rs. 17—4—0 in Rajahmundry, and Rs. 13—11—0 in Vizianagaram. When compared with the prices reported in the previous report, i. e., those which prevailed on 13th August 1949, these prices reveal a rise of approximately 32 per cent in Kakinada, 16 per cent in Visakhapatnam, 10 per cent in Adoni, 8 per cent in Bellary, 7 per cent in Vizianagaram and Coimbatore, 4 per cent in Cuddalore and 3 per cent in Vellore and Tiruchirapalli, the prices remaining stationary in Erode, Mangalore and Chittoor.

Statistics — Pepper — 1949 — First forecast report: The area under pepper upto 25th August 1949 in the districts of Malabar and South Kanara is estimated at 93,500 acres, (85,200 acres in Malabar district and 8,300 acres in South Kanara district) as against 92,500 acres (83,400 acres in Malabar district and 9,100 acres in South Kanara district) estimated for the corresponding period of last year. Due to excessive rains in Malabar at the time of ploughing and setting the yields are expected to be below normal in that district. The condition of the crop is fair in South Kanara district and normal yields are expected. The wholesale price of pepper per Imperial Maund of 82 2/7 lb. or 3,200 tolas as reported from important market centres on 10—9—1949 was Rs. 331—4—0 in Kozhikode, Rs.30 8—8—0 in

Mangalore and Rs. 305—8—0 in Tellichery, when compared with the prices published in the final forecast report for 1948 i. e. on 8—1—1949, these prices reveal an increase of 181% in Kozhikode, 145% in Tellicherry and 62% in Mangalore.

(From the Economic Adviser, Government of Madras.)

Cotton Raw, in the Madras Presidency: The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 amounted to 3,28,365 bales of 392 lb. lint. The receipts in the corresponding period of the previous year were 3,24,177 bales, 4,34,157 bales mainly of pressed cotton were received at spinning mills and 4,445 bales were exported by sea while 86,089 bales were imported by sea mainly from Karachi and Bombay.

(From Director of Agriculture, Madras.)

Agriculture College and Research Institute, Coimbatore

LIST OF ADDITIONS TO LIBRARY FOR SEPTEMBER 1949.

1.	ANDERON: (Edvar)	Introgressive hybridisation.	1949
2.	BEVERIDGE (William):	Social insurance and allied services Report (reprint)	1949 1948
3.	CONN (H. J.):	History of Staining—Edition 2.	1948
4.	CONN (H. J.):	Biological stains—a handbook on the nature and uses of the dyes employed in the biological laboratory Edn. 2	1948
5.	COTTON (C. A.):	Landscape as developed by the processes of normal erosion Edn. 2. Revised and enlarged.	1948
6.	DONALD (E.H.) Frear:	Catalogue of insecticides and fungicides Vol. II Chemical fungicides and Plant insecticides	1948
7.	GILMAN (Joseph G):	Manual of Soil fungi	1947
8.	IMMS (A.D.):	General text book of Entomology, including the anatony, physiology, development and classification of insects Edn. 7.	1948
9.	KENNIS DOOR (Warren):	Zaden atlas. der Nederlands che Flora Len Bcheeve Van de Botanic. Palaeon fologre Bodemaculture	1947
10.	KRISHNAN (M. S.):	Geology of India and Burma	1949
11.	LYON (Lyttleton) and Buckman (Harry O.):	Nature and properties of soils: a college text book of edaphology Edn. 4. revised	1949
12.	MARTIN (Hurbert):	Scientific principles of Plant protection with special reference to chemical control. Edn. 3	1948

13.	MITCHELL (John W) and MARTH (Paul C.) :	Growth regulators for garden, field and orchard	1947
14.	PATERSON (William F):	Man, weather and sun Edn. 1.	1947
15.	PATIL (P. C.):	Food problems in India in general and in Kolhapur State in particular.	1948
16.	PHILLIPS (John):	Agriculture Act. 1947	1948
17.	RHIND (D):	Grasses of Burma, 1945	
18.	ROBERTS (William) and KATAR SINGH (S.B.S.):	Text book of Punjab Agriculture	1947
19.	SKINNER (charles E):	Henrici's Molds, Yeasts and Actinomycetes—a handbook for students of Bacteriology. Edn. 2	
20.	SNEDECOR George W):	Statistical methods applied to experiments in Agriculture and biology Edn. 4. 3rd print	1948
21.	SOUTHGATE (B.A.):	Treatment and disposal of Industrial waste waters, reprinted 1945	
22.	VAKIL (C. N.)	Economic consequences of partition	1949
23.	VISWANATHA IYER (K.P.):	etc., Indian Press Yearbook.	1949
24.	VAN MUREN (J.PJ.):	Soil fertility and sewage—an account of pioneer work in South Africa in the disposal of town wastes	1949
25.	WESTON (W. A. R. Dillon) and Taylor (R. Eric):	Plant in health and disease	1948

26. A Ceruti ungi.· Analytice. De lineati. I combus Pictis illustrati. fungi and their structre Les. champignas. Leier Anatomic et. Histoire. Vol. I. 1948

27. Annual Report on the progress of Chemistry for 1947.

28. Advances in Biological and Medical Physics Edited by H. Lawrence and Joseph G. Hamilton I Vol. 1489

29. Everybodies Radio manual: How to build and repair radio receivers prepared by the Editorial staff of Popular Science Monthly 1942

30. Indian Union map (Commerce map of the Indian Union);

31. Note book of Tropical agriculture: Compiled by R. Cecil weed. 1948

32. Radio for the millions, prepared by the Editorial staff of the Popular Science Monthly. 1946

33. Trees for towns and country—a selection of sixty trees suitable for general cultivation in England prepared for the Association for planting and regional reconstruction.

D. B. K.

Weather Review — For September 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalapore	6·7	—0·8	17·3
	Calingapatam	10·3	+3·4	23·5
	Vizagapatam	11·6	+5·0	26·3
	Anakapalle*	14·7	+7·1	32·7
	Samalkot*	9·3	+4·1	32·4
	Kakinada	7·0	+0·8	42·2
	Maruteru*	5·2	—0·6	32·8
	Masulipatam	7·0	+0·6	37·8
	Guntur*	5·3	+0·1	32·0
	Agrl. College, Bapatla*	12·0	+3·8	41·5
	Veeravanam* (College Farm)	14·1	(x)	38·2
Ceded Dists.	Kurnool	17·7	+11·7	34·6
	Nandyal*	...	...	...
	Hagari*	6·1	+1·6	14·2
	Siruguppa*	10·6	+4·9§	22·6
	Bellary	5·9	+1·0	14·0
	Rentichintala	4·1	—0·7	25·4
	Cuddapah	7·8	+1·8	28·6
	Anantha-rajpet*	5·9	+2·5	34·2
Carnatic.	Nellore	8·5	+4·0	34·3
	Buchireddi-palem*	8·3	+5·4	26·5
	Madras	6·8	+2·1	27·8
	Tirurkuppam*	12·5	+6·5$	42·2
	Palur*	3·8	—4·0	25·2
	Tindivanam*	3·5	—2·8	19·9
	Cuddalore	2·8	—2·4	23·0
Central.	Vellore	4·0	—2·9	32·5
	Gudiyatham*	3·3	—2·0	30·5
	Salem	3·7	—2·4	24·9
	Coimbatore (A. C. R. I.)*	0·2	—1·1	9·5
	Coimbatore (C. B. S.)*	0·2	—1·5	10·2
	Coimbatore	0·3	—1·3	11·0
	Tiruchirapalli	7·0	+3·0	28·3

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	3·7	+0·4	15·2
	Aduturai*	5·0	+1·1	22·6
	Pattukottai*	4·0	—0·1	17·7
	Mathurai	5·1	+0·4	33.5
	Pamban	0·1	—1·0	11·1
	Koilpatti*	0·8	—2·0	13·00
	Palamcottah	...	...	13·0
	Amba-samudram*	1·1	+0·1	8·0
West Coast.	Trivandrum	4·0	—0·5	47·0
	Cochin	27·4	+19·7	124·4
	Calicut	16·3	+9·7	128·3
	Pattambi	11·0	+7·1	91·5
	Taliparamba*	15·3	+7·1	155·0
	Nileshwar*	17·8	+9·0	162·6
	Pilicode*	17.8	+8·4$	155·8
	Mangalore	17·0	+7·6	156·6
	Kankanady*	17·4	+8·2	157·7
Mysore & Coorg.	Chitaldrug	3·1	—1·3	12·9
	Bangalore	4·0	—2·7	31·7
	Mysore	1·6	—3·4	18·4
	Mercara	20·7	+9·6	113·6
Hills.	Kodaikanal	2·8	—4·5	33·1
	Coonoor*	3·2	—0·6	23·0
	Ootacamund*	1·8	—3·0	30·3
	Nanjanad*	6·0	+1·3	33·7

Note :—

(1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal.

(3) x Readings are recorded only from February 1948.

(4) $ Average of six years data for Tirurkuppam and seven years data Pilicode is given as normal.

(5) § Taluk office normal is .... and rainfall ....

(6) ... Figures are not available.

Weather Review for September 1949

The monsoon was active along the West Coast during the beginning of the month causing widespread rains in Kerala and South Kanara. But owing to a general rise in pressure over the whole country on 4—9—49 the monsoon became feeble. The presure over the country fell below normal on 6—9—49 and a shallow depression associated with markedly unsettled conditions was observed off the East Coast between Chandbali and Vizagapatam on 7—9—49. This resulted in the strengthening of the monsoon along the Kanara Coast. The Bay depression crossed the coast on 8—9—49 causing widespread rains in North Andhradesa.

The monsoon was apparently strengthening in the South-East Arabian Sea on 10—9—49 causing widespread rains in Malabar, but became weak on 11—9—49. The monsoon strengthened the very next day due to the development of upper air discontinuity and a shallow low in association with a low pressure wave, which moved into the central bay from the Andaman Sea, resulting in widespread rains along the West Coast and thundershowers at several places in Andhradesa and Tamilnad. The shallow "low" moved inland on 19—9—49 and became unimportant after four days.

Another low pressure wave moved into the East Central Bay from the North Andaman Sea on 17—9—49, causing unsettled conditions and a deep depression over East Bay, which moved North-West bringing the upper winds upto 12,000 over eastern half of the Peninsula into the grip of cyclonic circulation on 19—9—49. This deep depression crossed the coast near Masulipatam on 21—9—49 and passed over Hyderabad-Deccan to the Central Provinces and got filled up on 25—9—49. This resulted in widespread and local heavy rains in Andhradesa and Rayalaseema from 20—9—49 to 24—9—49 and floods in the Krishna river. From 12—9—49 to 25—9—49 there were fairly widespread rains in Malabar and South Kanara. There was a general rise in pressure over the country on 26—9—49 and air became drier over South Malabar resulting only in local showers over the region till 30—9—49.

The note-worthy falls in the month are given below :—

Date	Place	Rainfall in inches
3—9—1949	(Nungambakkam) Madras	2·8
7—9—1949	Kozhikode	2·9
8—9—1949	Calingapatam	2·2
14—9—1949	Cochin	2·8
18—9—1949	Mangalore	2·5
19—9—1949	Anantapur	2·1
20—9—1949	Alleppey	4·6
21—9—1949	Nellore	3·7
,,	Cuddapah	2·9
,,	Kurnool	4·7
,,	Ongole	4·6
22—9—1949	Ongole	9·2
,,	Kurnool	3·9
26—9—1949	Vizagapatam (Aerodrome)	5·7

C. B. M.

Departmental Notifications

GAZETTED SERVICE—POSTING AND TRANSFERS.

Name of Officers	From	To
Sri Bujanga Rao, C.	On leave,	Asst. Fruit Specialist, Banana Research, Station, Aduthurai.
,, Muthaiah Nattar, A. M.	On leave,	D. A. O., Mathurai.
,, Nair, P. N.	Special D. A. O., Coimbatore,	D. A. O., Ootacamund.
,, Suryanarayana, V.	D. A. O., Ootacamund,	Asst. M. O., Kakinada.

SUBORDINATE SERVICE.

Sri Amirtha Raj, E.	A. D., Mathurai,	Paddy Asst. Seed Development Scheme—N. Arcot District.
,, Arunachalam, T.	A. D., Melur,	A. D., Hosur.
,, Anavarathan, L.	Asst. in Millets, Coimbatore,	Asst. in Millet, A. R. S., Koilpatty.
,, Anantham Pillai, S.	On leave,	A. D., Gobichettipalayam.
,, Akkaya, N.	F. M., A. R. S., Siruguppa,	Paddy Asst. Seed Development Scheme, Amalapuram.
,, Bhaskara Rao, V. K.	Asst. in Mycology, Coimbatore,	A. A. D., Gobichettipalayam.
,, Chakko, C. J.	Asst. in Fruits, Mettupalayam,	A. D., Alathur.
,, Dakshinamurthi, V.	F. M. Araku.	A. A. D., Rajahmundry.
,, Dinaker Rao, K.	A. D. Udipi,	Paddy Asst., S. Kanara Dt.
,, Dharmalingaswami, P.	A. D. Bellary,	Asst. in Millet; Seed Development Scheme, Bellary.
,, Gopala Rao, M.	A. D. Palagoda	Paddy Asst., Seed Development Scheme, Chicacole.
,, Gnanavaram, I.	Ento-Mycology Training at Coimbatore,	Plant Protection Asst., Pattukottai.
,, Hanumantha Rao, B.	A. D. Ongole,	Millet Asst., Seed Development Scheme, Cuddapah.
,, James Colaco.	On leave,	Special A. D., Sugarcane Scheme, Mangalore.
,, Kalimuthu, M.	A. D., Bhavani,	A. D., Gudiyatham.
,, Koteswara Rao, M.	A. D., Hospet,	Asst. in Paddy, Seed Development Scheme, Vijayavada.

Names	From	To
Sri Lakshmanan, S.	Teaching Asst. in Agricultural Training School, Orthanad,	A. D., Mayavaram.
,, Muthuswami, T. D.,	A. A. D., Villupuram,	Paddy Asst. Seed Development Scheme, Villuppuram.
Mr. Mohammad Maqbaloor Rahiman,	A. D., Kurnool,	Paddy Asst. Seed Development Scheme, Tanuku.
Sri Nalla Gounder, S. C.	A. D., Krishnagiri,	A. A. D., Attur.
,, Narasimha Rao, R.	A. D., Alur,	A. A. D., Avanigada.
,, Narasimhamurthi, H.	Special A. D., (Sugarcane) Hospet,	A. D., Hospet.
,, Narasimha Rao, I. L.	A. D., Sattanapalle,	Millet Asst. Seed Development Scheme, East Godavari.
,, Narasimham, B.	Horticultural Asst. Agricultural College, Bapatla,	Paddy Asst. Seed Development Scheme, Kishna.
,, Nageswara Rao, T.	A. D., Bapatla,	,, Guntur.
,, Narayana Iyer, N.	On leave,	A. A. D., Chingleput.
,, Nagaeswara Sarma, D.	A. D., Rapur,	Paddy Asst. Seed Development Scheme, Gudivada.
,, Narayanaswamy, K. H.	Paddy Asst. Pattukottai,	,, Pattukottai.
,, Padmanabha Raju, P.	On leave,	,, Vijayavada.
,, Prahlada Rao, G.	Soil Conservation Asst. Bellary,	A. A. D., Bellary.
,, Radhakrishnamurthi, K.	Soil Conservation Asst. Bellary,	F. M., Samalkota.
,, Raman, A.	Asst. in Millets, Coimbatore,	A. D., Bhavani.
,, Ramana Rao, D. V.	F. M., S. R. S., Anakapalli,	Paddy Asst. Seed Development Scheme, S. Vizagapatam District.
,, Ramalingam, M.	On leave,	Paddy Asst. Seed Development Scheme, Nellore.
,, Rama Rao, B. K.	A. D., Hosur,	Speccial A. D., Firka Development Work, Kumlala.
,, Sankaranarayana Iyer, C. S.	A. D., Palghat,	Paddy Asst. Seed Development Scheme, Palghat.
,, Syed Mohmmad, D. H.	On leave,	A. D., Krishnagiri.
,, Srinivasan, K. V.	Asst. in Mycology, on Deputation at I. A. R. I., New Delhi,	Asst. in Mycology, Coimbatore.
,, Subbaiah Pillai, R.	A. D., Thirumangalam,	A. D., Firka Development Scheme, Thirumangalam.
,, Sankaranarayanan, R.	Millet Asst. A. R. S., Koilpatti,	A. D., Thirumangalam.
,, Satyanarayana Rao,	Soil Conservation Asst.	A. D., Ramachandrapuram.

Names	From	To
Sri Suryanarayana Sarma,	A. D., Rayachoti,	Paddy Asst. Seed Development Scheme, Godavari.
,, Srinivasan, V.	A. D., Ramanad,	Millet Asst. for Ramnad and Tinnevelly with H. Q. at Koilpatti.
,, Sriramulu, K.	On leave,	Millet Asst. Seed Development Scheme, Narasaraopet.
,, Satyanarayana Rao, G.	A. D., Palmaner,	Paddy Asst. Seed Development Scheme, Anantapur.
,, Sangameswara Sarma, S.	Teaching Asst. in Agri. Agricultural College, Bapatla,	Asst. in Charge Pulses. Breeding Station, Vizayanagaram.
,, Venkatanadha Chary, G.	A. D., Adoni,	Paddy Asst. Seed Development Scheme, Bhimavaram.
,, Veerabhadra Rao, N.	A. D., Uravakonda,	Millet Asst. Seed Development Scheme. Anantapur
,, Venkatapathi Naidu, C.	A. D., Hadagalle,	,, Kurnool.
,, Vaidyanathan, N. S.	A. D., Alathur,	,, Palghat.
,, Sithapathi Rao, C.	F. M., Hagari,	Soil Conservation Asst. Bellary.
,, Narayana Reedy, B.	Special A. D., Hindupur,	,, ,, Bellary.
,, Ranganathaswami, G,	P. A., to D. A. O., Vijayavada,	Millet Asst. Seed Development Scheme, Cuddapah.
,, Hanumantha Rao, D.	F. M., Agricultural College, Bapatla.	P. A., to D. A. O., Vijayavada.

The following B. Sc., (Ag.) Graduates are appointed as upper subordinates and are posted to the vacancies shown against each.

Name	To
Sri Appavu Naidu. C.	A. A. D., Madanapalli.
,, Azamatulla Khan.	A. A. D., Vijayavada.
,, Anjaneyulu, K.	Asst. in Fruits, Mettupalayam.
,, Banjee Rao, B.	A. A. D., Chidambaram.
,, Butcheswara Rao, A.	,, Chodavaram.
,, Bhaskara Rao, K.	,, Gannavaram.
,, Balasubramaniam, K. R.	,, Erode.
,, Bhaskara Rao, U. K.	Asst. in Mycology, Coimbatore.
,, Balasundaram, I.	A. D. Dharmapuri.
,, Balasubramaniam, K. N.	A. A. D. Udamalpet.
,, Dorai, S.	A. D. Nilakottai.
,, Dharma Rao, B.	A. A. D. Kudligi.
,, Gopalakrishnaiah, K. V.	,, Atmakur.
,, Gopala Rao, B. V.	,, Nellore.

Name	To
Sri Gangaprasada Rao, N.	,, Ongole.
,, George Vasantha Rao,	,, Eluru.
,, Gopalaratnam, G.	,, Cuddalore.
,, Gopinath, M.	A. D. Sidhout.
,, Gopinatha Rao, P. V.	,, Palmaner.
,, Harichandramurthi, L.	A. A. D. Tenkasi.
,, Jayaraman, A.	,, Bobbili.
,, Krishnamurthi, P. P. V.	A. D. Rapur.
,, Krishnasarma, J.	,, Kurnool.
,, Krishnamurthi, M.	A. A. D. Gudiyattam.
,, Kameswarasarma, V.	,, Thiruvannamalai.
,, Krishna Mohan, V.	A. D. Ramnad.
,, Krishnamurthi, P. S.	,, Wallajah.
,, Krishnamurthi, T.	Asst. in Paddy, Coimbatore.
,, Koteswara Rao, K.	A. A. D. Alur.
,, Krishnamurthi, B. H.	,, Anantapur.
,, Karunakara Rao, A.	,, Kurnool.
,, Krishnamuthi, P.	,, Jammalamadugu.
,, Lakshminarayana, M.	,, Kadiri.
,, Madhava Rao, T.	A. A. D., Gudivada.
,, Muthugopal, K. R.	Teaching Asst., Agrl. Training School, Orathanad.
Janab Md. Abdul Hameed,	A. A. D., Bhimavaram.
Sri Mallikarjuna Rao, Y.	,, Tanuku.
,, Manickaya Rao, V.	Soil Conservation Asst., Bellary.
,, Neelakantiah, O.	A. A. D., Vellore.
,, Narayanan, S.	Asst. in Mycology, Coimbatore.
,, Narasimha Rao, P.	A. A. D., Kurnool.
,, Narayan Rao, B.	A. D., Hadagalle.
,, Narayana Reddi, M. L.	F. M., Bapatla.
Sreemathi P. Parvathi.	Lady Demonstrator, Kakinada.
Sri Patnaik, U. J.	A. A. D., Pithapuram.
,, Purnapragnachar, H.	A. D., Adoni.
,, Ramakrishna Rao, J.	,, Anakapalli.
,, Ramachandra Rao, M.	A. A. D., Polur.
,, Ramana Rao, A.	,, Tanjore.
,, Ramachandra murthi, A. S.	A. D., Koilpatti.
,, Rama Rao, K.	A. A. D., Sringavarapukottai.
,, Rajaratnam, J.	,, Amalapuram.
,, Ravindra Rao, G.	,, Repalle.
,, Ranga Reddy, B.	,, Nandyal.
,, Rafeuddin Elias Khany.	,, Adoni.
,, Ratnakara Rao, T. V.	,, Hospet.
,, Ramesan, V.	Asst. in Oilseeds, Tindivanam.
,, Ramani, P.	Special A. D., Udumalpet.
,, Swaminathan, S.	A. D., Perambalur.
,, Sundhara Singh, M.	,, Tenali
Sreemathi Pushpaveni	F. M. S. R. S., Anakapalle.
Sri Suryanarayana, P.	A. D., Cuddapah.
,, Sadasiva Reddy, G.	A. A. D., Cuddapah.

Name	To
Sri Siva Reddi, S.	,, Hindupur
,, Subbiah, J.	,, Kandukur.
,, Shaik Imam.	,, Kovur.
,, Suryaprakasa Rao, P.	,, Markapur.
,, Seshachala Sarma, C.	,, Kakinada.
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The Madras Agricultural Journal

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Editorial

Cotton and Sugarcane: The out put of raw cotton is to be increased by five laks of bales. This was the decision arrived at the conference of provincial agricultural ministers recently held in Bombay. Preference is to be given to long staple cotton, which has hitherto been largely imported from countries outside India. The cotton industry is now facing a crisis. The inadequate supply of raw cotton has resulted in keeping many mills idle and throwing the industry out of gear. Though the food problem is by far the most important facing the country, the question of feeding our industries cannot be neglected without serious detriment to the national economy. It was the appreciation of this fact, we believe, that has led the conference to arrive at the decision of increasing the out put of cotton in the country. How far the increase in cotton production will interfere with the Grow More Food Campaign it is difficult to surmise. But it has been pointed out that it is not necessary to encroch on the area meant for food crops but cotton could be profitably grown as a mixed crop with groundnut without serious detriment to the latter. Moreover, savings in foreign exchange resources effected by non-purchase of cotton from outside will to some extent off set the price we have to pay for import of food from abroad There is reason to believe that surplus wheat production which has been reported from America, Australia and parts of Europe may result in lowering the prices of cereals in the world market. The net gain in our national economy will therefore be on the whole beneficial to the country if it is made less dependent on foreign countries for its cotton and other raw materials for its industry. With regard to sugar the reason for shortage is not clear The Sugar Committee which may be presumed to have full knowledge of the facts concerning the industry are of the opinion that the present scarcity is artificially created. If it were so, it is up to the people responsible to rise above their private interests and remedy the existing state of affairs

The appeal of Sardar Patel to the industry appears to have had some effect and we hope that before the present season is over the supply of sugar would be sufficient to meet the needs of the country.

The Prime Minister and Deputy Prime Minister: India is fortunate in having two such men as Pandit Nehru and Sardar Patel at the helm of its affairs at the present juncture. During these two years of stress and strain they have proved themselves to be supermen and though bereft of the guiding hand of their master they have faced the tasks set before them with undaunted courage and outstanding ability. The country is grateful to them and the Madras Agricultural Journal joins in rendering its respectful homage to them and wishes them all success in their great endeavour of making India a great nation.

Cyclone havoc in Andhra Desa: The Cyclone havoc in the Andhra Districts has now been roughly estimated and large tracts of valuable paddy lands have at least temporarily been laid waste and a large number of harvested and standing crop lost; cattle have been washed away. To rebuild this area an appeal for funds has been sent out. We add our appeal to our readers, to donate liberally for the cause of this relief

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NOTICE TO SUBSCRIBERS.

The cost of printing and paper is still high. We appeal to such of our members as are in arrears and other members to kindly remit their subscriptions early.

Studies in preparation, preservation and renovation of butter and ghee

By

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Ghee is the most convenient form in which milk fat could be preserved for human consumption, especially under tropical and sub-tropical conditions. The importance of ghee in our dietary is well known and need not be emphasized here. Unfortunately, ghee that is made available in the markets to the bulk of the population is deplorably poor in quality, with an unpleasant smell and is often adulterated. Adulteration is intentional, the motive being excessive profiteering. Other reasons for the bad quality are entire indifference and ignorance to an extent on the part of producers in preparing and preserving the product. Good ghee can be easily made and at no greater cost than bad or indifferent ghee.

The factors responsible for the spoilage of ghee have been found by the various workers to be the following :

(1) Unsuitable and improperly cleaned vessels used for handling milk, curds, butter and ghee. (2) Defective boiling of milk for conversion into curds. (3) Bad quality starters and defective ripening. (4) Accumulation of butter for a number of days to get sufficient quantity for conversion into ghee. (5) Improper washing of butter, that is, free of the adhering and heldup curd particles. (6) Defective storage of ghee, exposed to air and light which hasten the spoilage of the product and (7) Contact with porous earthenware and metals like copper, brass and iron without proper tinning, which increase the spoilage.

The defects pointed out in ghee making and storage are controllable, and good ghee could be produced, which would keep well for reasonably long periods. Studies were made with the object of evolving suitable methods of making butter and ghee with low initial acidity and methods of renovating bad butter and ghee, that are normally available in the market. The study was confined to practical methods that could be easily adopted in an ordinary household without any additional out-lay or equipment.

For all these trials buffaloes milk produced in the College Dairy was boiled and converted into curds. Butter was made from curds by the local method using the churning rod. All attempts were made to maintain uniform quality in curds, butter and ghee throughout the trials.

I. **Quality of butter**: *Washed Vs., Unwashed butter*: Butter was made from curds by the ordinary local method. The butter that floated on the butter-milk after churning was gathered. One third of this quantity was bulked and pressed with scotch hands on a butter board to remove as much of the butter-milk as possible. This was taken as unwashed sample. The remaining two thirds was transferred to a vessel of water and gently agitated for a few minutes to wash the butter granules. Half of this quantity was taken as the once washed sample, and was well pressed to remove as much wash water as possible. The remaining third was gathered, drained and transferred to another vessel of water for giving a second washing. The butter grains were agitated for a few minutes and pressed. This was taken as the twice washed sample. The acidity of the three samples of butter were determined by the Nissen's method and expressed as lactic acid. The same method of testing acidity was followed throughout the trials. The three fresh lots were converted into ghee. The ghee was filtered to remove the sediment and the samples were tested for acidity. The results of the analysis are furnished below:

	Perceneage acidity: Butter	Ghee
Unwashed	0·0871	0·0526
Once washed	0·0615	0·0379
Twice washed	0·0571	0·0320

The above results indicate that washing the butter reduces the acidity of butter and the resulting ghee. Hence washing the butter grains free of the adhering curd particles and butter-milk helps to give ghee with a lower initial acidity. Acidity is one of the factors promoting rancidity in ghee and reducing its storage life. The low acid ghee can be preserved without much of deterioration over a longer period than ghee with high acidity.

II. **Preservation of butter**: Fresh butter from most houses is of fair quality. The butter produced every day is small and it is accumulated till a sufficient quantity becomes available for melting into ghee. But the butter deteriorates during storage and develops a sour smell, due to the increase in the acidity of the enclosed butter-milk. Putrid odour of varying degrees develops due to changes in the proteinaceous curd particles held up by the butter. Moulds also develop on the surface of butter occasionally and such samples are devoid of the characteristic butter flavour. The deterioration that sets in butter during storage is marked and in most cases accounts for the bad quality of the resulting ghee.

The following methods of storing butter were studied with a view to find out the best method suitable for the ordinary household: (1) Dry preservation — by keeping the lump of butter in a vessal, without

any treatment. (2) Preservation under brine — by pressing the butter firmly to the bottom of a vessel and keeping it submerged in saturated common salt solution. (3) Preservation under water — by pressing the butter firmly to the bottom of a vessal and keeping it submerged in water. (4) Preservation under butter milk — by pressing the butter firmly to to the bottom of a vessal and keeping it submerged in butter-milk.

Water and butter-milk used for submerging the butter were changed every day. In all cases small aluminium vessals of the same size and shape were used and covered with lids and kept inside a cup-board. Samples of butter were drawn on the 4th, 8th and 12th day and converted into ghee. The acidity of the butter and ghee samples were as follows;

Days of storage of Butter.	% Acidity as lactic acid.			
	Methods of storage			
	Dry.	Under Brine.	Under Water.	Under Butter-milk.
		Butter.		
0	0·0775	...	...	...
4	0·1086	0·1251	0·0950	0·0937
8	0·1551	0·1413	0·1061	0·0937
12	0·1636	0·1885	0·1619	0·1830
		Ghee.		
0	0·0506	...	...	...
4	0·0657	0·0706	0·0613	0·0547
8	0·0780	0·0750	0·0715	0·0694
12	0·0850	0·0756	0·0739	0·0897

The following observations were made during the storage of butter and the making of ghee:

A. BUTTER: (i) *Dry preservation*: Butter got dried up on the surface by losing moisture. The dry appearance got more pronounced with increase in the storage period. From the 8th day onwards there was change in colour and decrease in flavour. On the 12th day the butter was badly mouldy, and off-flavour was very marked. (ii) *Brine preservation*: There was no change in colour. From the 8th., day onwards there was loss in flavour and on the 12th., day off-flavour was marked. But the quality was much better than the dry preserved sample. (iii) *Water preserved*: The changes were exactly the same as in the case of brine preserved butter. (iv) *Butter-milk preserved*: There was no change in colour right through. The flavour was also maintained even till the 12th., day. The butter looked fresh with the characteristic butter-milk flavour. This was the best of the lots, and good enough for consumption as butter.

B. GHEE: (i) *Dry preserved butter*: Due to the dryness of butter, it took minimum time for conversion into ghee. During boiling, pungent odour was emitted, and there was also spurting of the material. These two characteristics, viz. pungent odour and spurting, were not met with in the other samples. Quality of ghee was tolerable, but the true ghee flavour was not conspicuous. Ghee made from 12 days old butter had a marked off-flavour. (ii) *Water preserved butter*: The quality of ghee made with 4 days old butter was fairly good. Ghee from the samples, 8 and 12 days old respectively, were not so good, but were tolerable. (iii) *Brine preserved butter*: The quality was exactly the same as that of the samples under water (ii). (iv) *Butter-milk preserved butter*: All the samples of ghee were fairly good and free from any off-flavour. The quality was decidedly better than ghee from the other samples.

Thus, preservation of butter under butter-milk appears to be the best method. Preservation under water is next best. Preservation under brine is unnecessary and dry preservation is undesirable. In any case, butter should be melted in as fresh a state as possible, preferably every fourth day as being convenient.

III. **Renovation of butter**: Trials were made with the object of renovating and improving the quality of bad quality bazaar butter. A portion of the butter was directly converted into ghee (sample A). The rest of the butter was well washed under the tap by kneading till the wash water was clear. A portion of the washed butter was boiled into ghee (sample B). The remaining portion was boiled with thin slices of fully ripe banana fruits (without rind) at one ounce of slices per pound of butter (sample C). In all the cases the butter and ghee samples were tested for acidity with the following results.

	% Acidity as lactic acid	
	Butter.	*Ghee.*
A. Bazaar butter	0·1741	0·0820
B. Washed butter	0·1125	0·0536
C. Washed butter boiled with banana slices	0·1125	0·0295

The unwashed butter had an acid smell and bad odour. The washed butter had acid smell and the colour was much improved due to the removal of the adhering dirt. But the butter got pasty and soft during washing and there was improvement in the quality of the resulting ghee. The butter was boiled with banana slices, till the slices were brownish in colour and flaccid at the end. While the ghee was cooling, the slices turned dark, got firm and looked like charred banana chips. The ghee made with the original sample of bazaar butter was bad. Washing the butter improved the quality of the resulting ghee. When banana slices were added during boiling, the ghee produced was free of bad odour and of fair quality.

IV. **Renovation of ghee**: A sample of bad smelling rancid ghee was reboiled with banana slices at one ounce to the pound, till the slices turned brown. During cooling, the slices turned dark in colour. The ghee was filtered and tested for acidity, with the following results: Rancid ghee sample 0·1221 ; reboiled with banana slices 0·0380.

The original sample of ghee was unpleasant in smell and repulsive to the taste. The ghee after reboiling with banana slices was passable in in flavour and taste. This appears to be a suitable method of renovating rancid ghee.

Summary: 1. Washing butter grains free of the adhering and held-up butter-milk before bulking gives good quality butter and ghee. 2. When butter is stored for some days, it is advisable to keep it submerged in thin butter-milk and change it every day. 3. Bad butter can be improved by washing it throughly with clean and sweet water, kneading it well during washing, till the wash-water is clear. The ghee obtained from washed butter is nearly normal. By adding ripe banana slice at an ounce to each pound of old butter, during boiling, fairly good ghee could be produced. 4. Rancid ghee can be renovated by boiling it again with slices of fully ripe bananas at an ounce to a pound (roughly 1 fruit per pound) till the slices get browned. The recommendations made are simple, practicable, cheap and easily adaptable.

The writer is greatly indebted to Sri V. T. Subbiah Mudaliar, Senior Lecturer in Agriculture, Agricultural College, Bapatla, for his guidance and helpful suggestions during the conduct of the trials. He is grateful to Sri M. R. Balakrishna Iyer Lecturer in Chemistry and his colleagues who were very helpful and provided laboratory facilities and technical help.

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Some economic spices of India

By

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It is a matter of gratification that our country is blessed with a number of useful spices like pepper, cardamom, clove, nutmeg, cinnamon, ginger and turmeric. An indication of the present position of spices in the country is presented below :

Names of spices.	*Acreage.*	*Annual crop production in lbs. ('000).*
Pepper	1,00,000	25,000
Cardamom	1,20,000	9.000
Ginger	12,000	9,600
Turmeric	50,000	1,50,000
Clove	200	200
Nutmeg	300	105
Cinnamon	400	1,000

By far the largest proportion of pepper production is from this country; cardamom, ginger and turmeric also have gained importance and rank high in the country's commerce. According to the available marketing reports, the annual export of spices to foreign countries is 1,51,000 cwts. of pepper, 10,500 cwts. of cardamom, 31,000 cwts. of ginger and 43,200 cwts. of turmeric. The position of clove, nutmeg and cinnamon however, remains very unsatisfactory. Although some of these spices are later introductions, the progress they have made over the last two and a half centuries and the position they have attained is far from satisfactory.

Distribution: The distribution of the spice-growing areas of this country can be indicated as: 1. The narrow belt of the low-lying country in the West Coast extending from Cape Comorin to the Ratnagiri Dt. in Bombay, which mainly grows cloves. 2. The humid hilly tracts of the Nilgiris, Lower Palnis and Tirunelveli are suited for a number of spice crops, particularly nutmeg, cardamom, clove and cinnamon. 3. The low-lying wet zones of Wynaad, Coorg, Mysore, Travancore, Cochin and Tirunelveli. The main commercial crop here is cardamom. 4. The wetter areas of Malabar, South Kanara, Coimbatore, Madura and Tirunelveli are known to cultivate ginger on a large scale. 5. The dry districts like Guntur, Cuddapah and parts of West and East Godavari, Salem and Coimbatore grow turmeric on a large scale.

Outside the limits of this province, cloves, cardamoms, turmeric and ginger are cultivated on a comparatively limited scale in Bombay, the Shan States, U. P., Bengal and the Punjab. It is estimated that out of about 2,87,000 acres covered by spices in the country over 2,46,000

acres are confined to the South Indian Provinces and States. It is therefore needless to over-emphasise the importance of spice production in this part of the country. Although the progress of the spice industry has been satisfactory in respect of a few spices, the progress made by other spices reveals that there is room for considerable improvement of the spice trade in this country.

Imports and exports: In pepper, cardamom, ginger and turmeric, India can claim an enviable position in the world market. She has not only been able to meet her own internal requirements but has also been able to maintain a consistent export trade for decades past. On an average, India exports annually about 1,50,000 cwts. of pepper, 30,000 cwts. of ginger, 43,000 cwts. of turmeric and 10,500 cwts. of cardamom, worth in all about two crores of rupees. At the same time, with cloves, nutmeg and cinnamon, India has been dependent on Ceylon, Burma and Java even for its bare domestic requirements. This contrasting picture, obviously, indicates that no sustained efforts have been made by the Indian planters and the State in respect of the latter crops. The probable causes for the slow progress made in this respect are examined below :

Handicaps and difficulties: Two and a half centuries have passed by since the introduction of cloves, nutmeg and cinnamon in this country but the area covered by these spices hardly exceeds 800 acres today. Coffee, which was introduced a century later now covers 65,000 acres of cultivated land in South India alone. Such a disparity between the first group of crops and the latter naturally means that the former have not appealed to the Indian planter on account of (1) the extra care and nursing that the crops require in the nursery (2) the abnormal pre-bearing period associated with these plants as a result of seed propagation, which often culminates in disappointment caused by a disproportionately large number of male nutmeg trees. (3) The unhealthy and malarial conditions of the regions to which these crops are best suited, (4) want of adequate transport and residential facilities to enable effective supervision and profitable marketing. It is not, therefore, a matter for surprise that pepper, ginger, turmeric and cardamom with their easier methods of vegetative propagation and more convenient areas of production have gained the favour and fancy of the planters. But this does not mean that the country should be allowed to remain perpetually dependent on foreign lands where also these spices are produced under similar conditions.

It is a fact that in most orchards, clove and nutmeg trees are given a secondary place and the extent of attention bestowed is nothing short of neglect. Even so, from the condition of the existing plantations of these spices, one can easily judge that the production of clove and nutmeg is comparatively easy. The fact that these spices still flourish, strewn and scattered under neglect, right from the West Coast upto the foot-hills

of the central districts, is not only a proof of their hardy nature, but also that they have got acclimatised large in areas of land suited for their culture. Further, the preliminary trials conducted at fruit centres in Araku Valley and Wynaad have indicated that these un-utilised regions are well suited for the cultivation of these spices. It is obvious, therefore, that space has not been a limiting factor for their progress; but if these areas had been properly managed the country's output would have been several fold of what it is now.

Suggestions to overcome handicaps: The difficulties therefore lie in other directions. Finding out easier and more reliable methods of propagation is one of the primary criteria. Preliminary propagational trials made at the Burliar Fruit Station have indicated the possibility of grafting cloves on its stock, and that of nutmeg on *Myristica beddomei* and the successful rooting of cinnamon shoots by layering. Germination trials conducted at the same station have also disclosed that the low germinations of nutmeg and clove seeds can be increased to 97 per cent and 60 per cent respectively. The unhealthiness of the tract no doubt presents a serious handicap, when the planter could bestow so much attention on coffee or tea under similar conditions, these spices should deserve at least an equal attention, considering the economic gains.

The high cost of transport is often mentioned as one of the stumbling blocks in the way of progress of these spice crops. Although one cannot entirely deny this, it cannot be gainsaid that the same factor is applicable to a number of other crops like fruits, and drugs which are grown under the same set of conditions, but it has not stood in the way of their progress. It would be seen from the data furnished below on the cost of production of a pound of clove, that transport by itself does not contribute so much towards swelling up the cost of production as the other items.

Approximate cost of producing of one pound of dry clove (in the 10th year of bearing) in a village near Burliar Fruit Station:

		Rs.	as.	ps
Cost of plant material	...	0	2	10
Cost of culture (inclusive of irrigation charges)	...	0	3	6
Charges on harvesting and transporting	...	0	0	7
Curing charges etc.	...	0	0	2
Total	...	0	7	1

It is no doubt to be admitted that the net cost is subject to variation depending upon the degree of accessibility or otherwise of the place where the spice is cultivated. Thus it is obvious that sustained efforts do not seem to have been made in the improvement of spices, on the imaginary fear of handicaps and hindrances. In order that the country may get the maximum benefits out of these crops a serious endeavour is called for on the part of Indian planters on the lines above indicated.

Conclusions: (1) The paper deals with the economic and commercial importance of some of the important spices of India. (2) A brief survey of the causes of the success and failure of the respective spice crops has been made. (3) The possible methods of crop culture which would go to set off the factors handicapping the progress of the spice industry have been indicated. (4) An appeal to the planter to make a serious endeavour to make good the deficiency in the spice crop production is made.

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Transmission of research on pest control

By

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Every cultivated plant or tree has its own specific insect enemies, and agricultural products, which, are grown and stored at so much expense and trouble, are also not exempt from the depredations of insects. It has been computed that over 200 species of insects occur as major pests and that the damage caused by them both in the field as well as the godown, deprives the ryot by about 10 to 15% of his legitimate earnings. It has also been estimated by various authorities that the overall food deficit for the entire country is from 7 to 15%. It would thus seem as if the entomologist by himself might be able to wipe out food deficit in the country by controlling insect damage to crops.

The Entomological Section of the Madras Agricultural Department was organised during the year 1912. The work has not always been quite an enviable one since it consists in organising a regular, unrelenting warfare against Nature, who, while having blessed us with her unlimited and bountiful resources, has also created the myriads of insect foes for us to contend with. Perhaps the chief handicap which has all along been felt was the inadequacy of staff, to transmit what little had been achieved by way of research, promptly and in time to the door of the ryot in times

of emergency. The situation was at no time more seriously felt, than during the present food crisis, when the resources of all governmental agencies had to be mobilised to save every plant raised and every grain harvested. The first urgent demand on the entomologist was during 1943, when a consignment of over 6,000 tons of imported wheat was threatened with complete ruin by insects at Madras. Since then the conservation of the large stocks of foodgrains, held in storage by the Government, from insect damage has become a routine work of the special entomological staff. In the wake of the above problem, the vagaries of the monsoons and other environmental factors, have favoured the multiplication of some of the major pests of field crops. Some of the forms which were till now dormant suddenly assumed serious proportions, while some others, which were practically insignificant so far, flared up into prominence. The recent intensive practice of crop cultivation, which has for its incentive the attractive prices of food stuffs, has been an important factor aiding the rapid multiplication of insect pests. The seriousness of the situation was realised by the ryots also and frequent requisitions for help and advice were pouring in from all parts of the Presidency. The experience of previous years, coupled with the discovery and easy availability of the two new insecticides - DDT and B. H. C. have enabled the section to rise to the occasion and handle the situation satisfactorily. More than that, the timely organisation of a separate plant protection agency for the Presidency, has been of immense help in transmitting the results of research to the ryots and popularising the approved methods of pest control. The object of this paper is to present a short account of the work done in this line.

The activities of the Entomology section may be classified under two categories, viz. (i) Protection of food-grains and (ii) Protection of crops and plants.

(i) **Protection of food-grains.** This branch though it was first organised to meet emergent cases of grain infestation, has subsequently become practically a food-grain protection service, in 1943, when the food crisis was just making itself felt, alarming reports were received about the badly-weevilled condition of about 6,000 tons of wheat imported from Australia. Immediate steps were taken to investigate the complaint and fumigation with calcium cyanide was decided to be the only resort. Suitable accomodation and the necessary machinery were improvised and the entire consignment was fumigated with success. Meanwhile, the Government also programmed the policy of importing enormous stocks of food-grains and keeping them in storage for a regulated issue to the public. This procedure created in its wake the problem of insects also. Investigations were immediately taken up to find out the ways and means of conserving the stocks and the following standardised policy was evolved and adopted. Experiments had shown that Calcium cyanide was about the best fumigant and that DDT and B.H.C. dusts were good disinfectants as well as prophylactics. Empty godowns are first cleaned and dusted

with one of the latter chemicals to eliminate the insect population, lurking in the corners and crevices. The bags are subsequently stacked according to specifications and if they get infested, they are fumigated with Calcium cyanide, Initial or re-infestation of the stocks is prevented by a periodical dusting on the bags with BHC D. 034. Adequate precautions are taken to see that the grains do not get damaged by the treatment. A technical staff of four officers with a complement of subordinate staff is attending to the work in the whole Presidency and the entire organisation is under the administrative control of the Board of Revenue. It is unnecessary to dilate here about the volume of the work turned out by this service, but it would suffice to say that food-grains are handled by lakhs of tons and every attempt is made to minimise the loss by insects.

(ii) **Plant Protection Service.** A plant protection staff comprising two officers one stationed at Bapatla for the northern districts and another at Coimbatore for the south – with an upper subordinate for each district specially trained for the work was sanctioned during the current year. The scheme began to function by about the middle of January, 1949. Each district was also furnished with the minimum equipment of dusters, sprayers, and the standard insecticides to meet all emergencies. The period under review, though short, had been unique in the successfully tackling of a number of major pests, mostly of food crops. Paddy which happens to be one of the staple crops of our Province had to suffer severely, from its insect enemies. The army worm of paddy *Spodoptera mauritia* broke out in all its virulence ever the Circars, West Coast and parts of the Tamil-Nad and about 640 acres of nurseries and 5.500 acres of planted fields were infested. Prompt control measures, such as flooding and sweeping the caterpillars were organised. Dusting with BHC D. 025, the latest insecticidal treatment was also advocatad, An acre requires about 10 to 20 lb. of the chemical costing about Rs. 8/- and this expenditure was not grudged by the ryot, as over two and a half tons of this chemical were purchased and used by them in the Circars alone. The rice grasshoper – *Hieroglyphus banian* – appeared on a large-scale, over 6,000 acres in Malabar and the latest methods of control were adopted with success in this district also. The same chemical – BHC D. 025 – was equally effective against the grasshoppers also and its use is rapidly becoming very popular. Another serious pest of paddy, is the paddy jassid – *Nephotettix bipunctatus*. Among the various chemicals tried, for the control of this bug DDT spray at 0.1% concentration was found to give very good results at a low cost of Rs. 6/- per acre. The pest appeared again this year over 300 acres in the Tamil Nad and was dealt with promptly. An effective remedy by way of dusting BHC D. 025 was discovered against the rice bug — *Leptocorisa acuta* — and this campaign was pushed on about 100 acres. The cost is neglegible compared with the probable damage, as it works out to less than Rs. 10/- per acre. The damage by the common field rats — *Gunomys Kok* — is being reported to be far more serious than that caused by most

of the other pests. Control measures advocated and practised, so far, were not convincing. The recent astounding results obtained with zinc phosphide used as a poison bait have practically solved the problem. The mortality of the rodents was so convincing that over 2,000 lb. of the chemical, enough to treat 20,000 acres were recently purchased and used by the ryots of the Northern Circars. Apart from the major pests, minor ones such as the smaller grasshoppers — leaf-eating caterpillars and beetles, plant bugs, etc., occurred sporadically in isolated areas and suitable measures were adopted. Crops coming under the category of millets also were subject to infestation by grass hoppers, the ear-head bug, etc., and all these were successfully dealt with. In the case of vegetables, hundreds of acres of brinjal were protected for its specific enemy — the *Epilachna* beetle, not to speak of other insects which infest this crop. The new insecticides have also been equally effective and were used on a large scale against thrips on chillies and garlic. Remarkable results were obtained against cutworms on potatoes and cruciferous crops on the Nilgiris with BHC D.025 which practically annihilated these worms and its use is becoming increasingly popular. Besides these, a number of pests on fruit trees, industrial crops like betelvine, oilseeds, etc., were promptly attended to. The research section at Coimbatore is, in the meanwhile, busy with finding out new methods of combating the insect foes. Interesting results have been obtained against a number of insects such as the pomegranate borer, the ber fruit fly, the agathi weevil, the mango hopper, etc., which were till now defying all our ingenuity and these will be popularised as soon as the tentative results are confirmed.

The resume of the work given above would serve to show clearly that the staff appointed have more than justified their existence. The benefits to the public by the grain storage service alone is enormous. Based on the encouraging results obtained so far, the Board of Revenue are seriously considering the expansion of the staff. The plant protection service under the Agricultural Department, though hardly six months old, has turned out creditable work and its future possibilities also are immense. Apart from carrying out the approved methods of control, the staff are also taking up field observations as and when there is need and it will not, be long before this Department has to approach the Government with proposals for expansion in this line as well.

Before concluding this note, it is also my duty to point out one major aspect, which seriously handicaps the efficiency of the service. Insect outbreaks generally occur all on a sudden over large areas and effect considerable damage before help reaches the place. In these days of acute transport difficulties, it has not always been possible to reach the workspot promptly, with the somewhat cumbersome and heavy appliances and large consignments of insecticides. Provision of a few mobile units for each division would go a long way to solve the problem and make for efficient service.

Some aspects of the transmission of the results of research into general farming practices

By

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Introduction: The ultimate aim of research in any branch of science is translation of its results into productive action. Most of the general public are interested in what is known as applied research alone and not in the fundamental work that must have preceded and been responsible for the results which are capable of direct application to specific purposes.

2. **Agricultural Research cannot be spectacular**: The results of agricultural research have got to be carried to a huge number of cultivators scattered over large areas and with varying economic status, and cultural development, unlike in the case of industrial research in which only a few resourceful and capable industrial magnates are primarily interested. Hence, the problem of translation of the results of agricultural research into productive action is very difficult. In many cases the benefits of the application of agricultural research are seldom spectacular and they are never immediate in the sense that they can be seen next day. For instance, by reducing seed rate in paddy and sugarcane the immediate benefit to an individual ryot is not spectacular. From about 80 lbs. of paddy seed sown in 8 or 10 cents to plant one acre, if it is reduced to 35 or 40 lbs. the saving of 40 lbs. costing at the present rate Rs. 4/- to 5/- is a mere nothing to the cultivator. But when the cumulative result of all the ryots adopting this method is visualised, the real benefit to the community in terms of the vital grain so urgently needed can be appreciated. For planting the 1,00,00,000 acres of irrigated paddy in this province about 10,00,000 acres of nurseries have to be sown. By adopting the improvement suggested, above 4,00,00,000 lbs. of paddy grain can be diverted for human consumption without merely going to waste. Similarly, in the case of sugarcane, reduction and seed rate from say 20,000 to 15,000 sets per acre results in a saving of 5,000 sets weighing about a ton. A ryot who is spending upto Rs. 1,000/- towards cost of cultivation does not feel the pinch of the extra expenditure of Rs. 40/- or 50/- towards cost of one ton of cane seed and hence may not bother to change his usual methods. But from the point of view of the province there will be a saving of 2,70,000 tons of cane (according to the latest available cane area) costing over rupees 121·5 lakhs. Thus if all the cultivators view this in such a perspective it is easy to spread this improvement and the agricultural prosperity of the country can be enhanced.

3. **More research and demonstration farms necessary:** This is a country of distances. Some of the districts in this Presidency are as big as some of the kingdoms of Europe and yet we do not have an agricultural research station for each district at least. Results achieved at a central research station cannot be applicable to distant places. For instance Co. 421 classified as a midseason maturing cane at Anakapalle was found to mature earlier in the Bobbili area. As a rule, cane varieties are earlier to mature at Gudiyattam than at Anakapalle. But the performance of the varieties in the Chodavaram area which is very near to the Sugarcane Research Station, Anakapalle, is practically similar to their behaviour on the research station. Hence the results achieved at any station can be straight away recommended for adoption only in neighbouring localities. But the research stations in this Province are few and far between and the improvements recommended by any station have to be further tested in the locality where they are sought to be introduced and in this process of testing and retesting a large amount of avoidable delay is caused. This delay is a check to the process in the popularisation of these results and increase the national prosperity, which will accrue by the adoption of these improvements. It is necessary to have at least a main research station for each district with liaison farms or demonstration farms in each important locality of the district to ensure easy and quick spread of the results of research into general farming practices. In this connection starting of farms like the Sugarcane Liaison farms is a very welcome feature. Important results achieved at the main research stations can be demonstrated here on field scale and problems of local importance tackled. If there are enterprising ryots or industrialists of the locality who are prepared to co-operate in the working the liaison farms their help may be sought for that purpose.

4. **Raising of economic status of cultivators is crux of the problem:** As mentioned in para two, the results of agricultural research have to be translated into farming practices by the cultivators who differ very widely with regard to their educational attainments and economic status. Education apart, it can be said emphatically that our ryots are more than shrewd, to understand the benefits accruing from a really good improvement. It is their economic status that mostly cripples their initiative to adopt some of the improvements suggested by the department. Nanavati and Anjaria, writing in the Indian Rural problem, held that nearly 70% of the holdings are uneconomic units in this country. Moreover, a large number of the cultivators are only tenants who have no permanent interest in the land they till. Writing about the Punjab peasantry in an article entitled 'Some thoughts on yield', Martin Leake said that the greatest handicap for the popularisation of results of agricultural research, was the low economic status of the peasants. The Punjab peasant is probably the richest man when compared to cultivators of the other provinces since he has organized irrigation and other facilities.

If he himself could not adopt all the improvements suggested by the local agricultural department, it can easily be realised that there is less scope for the Madras ryot, who is more often than not a tenant cultivator, to take up all the improvements.' Leake was referring to the average yields of wheat after thirty years of agricultural research in the Punjab. In spite of evolution of several high yielding strains and their spread to some extent the provincial average yield per acre did not go up, and was on the other hand slightly less than what it was three decades back. So unless the economic condition of ryots is generally improved they will be unable to adopt the suggestions given by the department to the fullest extent.

5. **Publicity is not enough**: It is recognised on all hands that advertisement is a fine art which needs a thorough training. There is no institution in the Province which trains persons in the arts of propaganda and publicity. It is a vital necessity to start such an institution and train suitable technical personnel for popularising the results of research and translating into general farming practices. To supplement the grow more food journals which are now primarily engaged in publishing the results of research in a popular manner in the regional languages the output of leaflets and pamphlets has to be increased to a great extent. These should be on the lines of the Farmer's Bulletins published by the United States Department of Agriculture dealing in detail with some aspects of cultivation in non-technical language in the local vernaculars.

6. **Role of vested interests**: There are instances of enactment of laws to control pests and diseases such as groundnut caterpillar, sugarcane smut and wheat rust. Similarly in some extreme cases, legislative compulsion seems to be necessary to push through agricultural improvements in certain localities. For instance in the vicinity of a big sugar factory of this province simple cultural improvements which are within easy reach of the cultivator are not taken up to increase the sugar recovery percent. There is the instance of sugar factories delimiting areas under high yielding and less rich canes. Thus, when there is a clash of interests the more powerful and resourceful person is getting the better of the other and thwarting the popularisation of really good improvements of national interest. More sugar per unit area is the main aim of the department, and more cane per acre is the aim of the factory ryot, whereas more sugar per ton of cane is the aim of the sugar factories. Legislation to control the activities of interested individuals or institutions who do not care for the larger good of the country has to be passed for translating the results of research into general cultivation practices with the ultimate aim of increasing production.

7. **Starting of co-operative societies**: Improvements involving investment of large sums of money can be popularised only by providing cheap credit to the needy cultivators. It is best done by encouraging and

helping formation of co-oparative societies. For instance, purchase of manures or insecticides or implements in a collective manner just in time for utilisation at the opportune moment, is possible through a co-operative society. New, anxious cultivators who wish to manure their crops early are being exploited by designing money lenders, by the imposition of exhorbitant conditions attached to the loan. The ryot is in many cases forced to sell his produce at comparatively cheaper rates to the money lender himself. Instances in abundance of such cases can be seen in Chodavaram and Anakapalle area in the Vishakhapatnam district. These irregularities can be avoided and even small ryots who are unable to manure their crops due to want of finance can also be benefited by becoming members of such societies. Another type of help which the co-operative societies can render to the farmers is construction of godowns and warehouses for storing produce to be sold at an advantageous price after some time. Jaggery manufacturing ryots knew to their cost how they lost heavily this season by selling their produce in December — January at 40 to 50 rupees per candy of 500 lbs. instead of at over 100 rupees per candy in May — June. By building warehouses as per departmental advice and giving advances on produce sold, the societies not only help in the spread of agricultural improvements but also help to raise the economic status of the cultivators which is a vital necessity for the rapid spread of the results of research into the general farming practices.

Summary and conclusions: The results of agricultural research have got to be carried to wider and a heteregeneous population unlike that in the case of other types of research. Agricultural research is less spectacular and the economic status of the ryots in many cases does not permit of their taking up certain improvements in the opportune time. Hence it is more difficult to translate the results of agricultural research into practical channels than in the case of other types of research. Many more research stations have to be started in representative localities for solving problems of local importance and facilitating recommendation of the results of research in the neighbouring tract. Liaison or demonstration farms have to be set up in as many places as possible for demonstrating the useful results achieved at the main research stations and quicken the popularisation and spread of the various improvements. Just as in the case of some diseases and pests legislation has to be passed if necessary for spreading certain improvements. Formation of co-operative societies will facilitate collective purchase of useful implements, manures, and insecticides etc. and will help in the spread of certain cultural practices recommended as a result of research over a number of years.

A note on the cultivation of Tapioca and derivative food products from it

By

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Tapioca and sweet potatoes, on account of their large carbohydrate content have an important place in the existing food economy of the country. With intensive propaganda on the use of these as vegetables as dehydrated or sundried chips, as flour or sago, it is possible to supplement the shortage of cereal production. It is said that even in the past, during periods of famine, tapioca and sweet potatoes have helped in tiding over the difficult period. What would have been otherwise a hopeless famine in the past has been reduced to a mere food crisis, with the aid of these subsidiary food crops.

Sandy loams, of five to six feet depth in preferably not low-lying areas are the best suited for tapioca. Loamy soils with a smaller percentage of sand are less suited for this crop, due to the greater resistance offered for the full development of the tuber. About four or five deep ploughings are given usually as preparatory cultivation. Five cart loads of mill wastes or ten cart loads of greenleaf are spread on the soil and covered well.

After levelling, the field is divided into two feet squares, both lengthwise and breadthwise. The best season for planting on high level lands is from June to September. In low levels it will be advisable to plant from October to January. The essential point to remember is that there should be very little moisture at the time of planting and about a month or two thereafter. Hence early plantings in low lying lands at the beginning of the monsoon will handicap tuber development on account of too much moisture in the early stages in the root zone.

Planting material. Full length shoots, immediately after harvest are planted in a cluster called "Podies", which are channels, 2 ft. wide 3 ft. deep and 10 ft. long, where one and half cartloads of shoots are placed vertically and covered up with earth, If there is sufficient moisture in the soil no irrigation is given. Otherwise it is moistened with a little water. The 'Podi' is said to be ripe for seed material usually after ten or twelve days when leaf buds just begin to put in their appearance. The latex in the shoots at this stage will be at a maximum. Each shoot is cut into nine-inch long sets and planted. Usually a "Podi" will provide sufficient material to plant an acre. On no account should a 'podi' be allowed to mature for more than a fortnight

or till the leaf buds change into leaves, as it then indicates that rooting has taken place at the bottom. Sets from such over mature shoots make poor seed material. The latex content in over mature shoots of 'podies' is considerably less and shoots also become pithy.

For introducing in new areas where the seed material is not available in the neighbourhood, it is best to take the shoots from the fields immediately after harvest, transport them expeditiously to the destination and to put them into a 'podi' in the new area. Even here the shoot must be planted in 'podies' within 4 days. Seed materials from 'podies' of growing areas, however quickly they are transported has not given satisfactory viability. It is due to the fact that the latex content dries up very rapidly and the usual precautions of covering them during transport do not prove of much use.

Seed rate and planting. Usually a 'Podi' or a cartload and a half of material cut into nine-inch sets give about 12,000 sets and this will plant an acre. The sets are planted vertically at every junction of the two feet squares, one each, more than two thirds of the length being inside the ground level. If there is not sufficient moisture, one irrigation is given. The plants will begin to root and put out green leaf buds in about a week.

Intercultivation. Hoeing between the rows is done once a week in the first two months and once a fortnight for the next four months. Irrigation is given once a week when there are no rains. For normal plantings, beds containing five plants each way, are formed usually in January or February, as the south-west and the north-east monsoons will be able to provide enough water between the two, upto the end of December. After January, irrigation has to be continued right upto the day of harvest, once a week if the maximum yield is to be obtained. But in great many cases due to scarcity of water in the wells, the plants get hardly any irrigation but even there, it is found the yield is good enough to leave a margin of profit to the growers.

Harvesting: Just before the actual harvest commences the field is irrigated once. It is advisable to harvest early i. e., when the crop is six to eight months old, for marketing the crop as a vegetable. But, for making sago or flour or chips, it is better to allow the crops to stand for full eleven or twelve months. Actual harvesting operation is done by a man gripping the bottom of the shoot with both the hands firmly, with legs planted squarely and pulling out. In a few cases where portions of tubers remain lodged in the soil they are dug out with the mammuti. The pulled-out tubers are cleaned, steeped in mud and carted either to the market or to the factory as the case may be. The steeping in the mud is necessary for preserving the freshness. By this means, the tuber can be kept fresh for four days. Twenty labourers can pull out,

and clean, an acre's produce, i. e., about four tons. Even where the plants are fully twelve months old, the tubers can be kept on in the ground for another six months without damage. This is a favourable point for the sago manufacturer, as it gives him time to prolong his working period.

Yields: A normal crop gives eight to ten cart-loads or four to five tons of tubers per acre. Even where the irrigation has been inadequate the yield is two to three tons per acre. The best tubers weigh 9 to 10 lbs. though the general average will be only one pound or so. When sold as a vegetable a viss or $3\frac{1}{8}$ lbs. at $2\frac{1}{2}$ annas will fetch a return about 400 to 500 rupees per acre. After meeting the working expenses a normal crop leaves him Rs. 100/- per acre as net profit.

Manufacture of Sago: (As a cottage industry): Robust, well developed, freshly-pulled-out tubers are brought to the factory site. The outer skin is peeled off, either with hand or with a knife. The peeled tubers are scraped into fine, uniform shavings by means of a hand-driven scraping machine. The scraping machine consists of a horizontal spindle with sharp, small curved spikes or projections over its entire surface. In the middle of the rotary there is a two-inch wide groove. The rotary is connected to a cranked wheel, by means of a circular rope which passes round the wheel and along the grove of the rotary like a belt drive. By turning the wheel the rotary begins to rotate on its own axle. While it is rotating the tubers are gently pressed against its surface and the shavings that fall off are collected in a tray placed underneath. The shavings so collected are taken to a cement tub, and mixed with water. They are then transferred on to a cloth and strained. The out flowing liquid is collected in another cement tub, with plugged outlet holes at different levels. After two or three hours of standing, a floury white mass settles down and the supernatant water is drawn out by unplugging one of the outlets. The white powdery residue is dried for an hour or two and sieved by means of a special superfine meshed sieve till all the fine flour is separated. The coarse flour is mixed with the next charge in the first tub. The sieved fine flour is placed on a clean, dry white cloth and oscillated gently till they form into uniform small pellets. These are then graded by means of a suitable sieve, bagged and sold as sago. Coalesced pellets and the coarse grain are marketed as *tapioca rice*, at a slightly cheaper price.

The pulp, left over after straining the starchy liquid is dried and fed to cattle or made into fine flour and sold about at Re. 1/- per maund of 25 lbs. for making kumkum (saffron) or as a substitute for Fuller's earth, or kieselguhr for making face powder of a cheaper quality. One ton of tubers give one sixth of a ton of sago. During the war period a maund used to sell about Rs. 20/- and one acre's produce used to bring in a gross-return of Rs. 1,200/-. The sago so manufactured keeps on its quality unspoiled for nearly a year.

Chips: (Sundried). After peeling off the skin, the tapioca tubers are cut into slices half an inch long and sun-dried for two days. This is used for curry or mixed in cooking along with meat and put to several other culinary uses. Fifty maunds of tubers give sixteen maunds of sun-dried chips or nearly one-third of it. The chips keep unspoiled for four or five months, provided it is sun-dried once a month.

Flour: Well-dried or dehydrat d chips are ground into fine flour and used as a substitute for rice flour, for almost all the preparations where rice flour happens to be the main constituent. Sixteen maunds of chips give about 13½ maunds of flour. The flour keeps on unspoiled, up to six months with occasional sun drying. The war-time price of flour used to be Rs. 45/- per cwt. The present price is about Rs. 22/- per cwt.

There is a great future for the growers of these subsidiary crops; with proper propaganda on the nutritive value of tapioca and sweet potatoes, many low-yielding sandy loams can be brought under these root crops with little expense and great profit. At present, the following factors are hampering maximum production. More than 50% of tapioca crops come to harvest after inadequate irrigation, due to want of water in the wells. A concerted drive to sink boreholes with the Government supplying the necessary equipment, even on a hire basis, will go a long way towards remedying the dearth of irrigation water. By starting processing factories for manufacture of sago and removing the export restrictions, and by conducting intensive propaganda for making greater use of the products of tapioca by the common man, the consumption and production of this crop can be stepped up to a considerable extent. Allotting manure purchase loans without interest at the time of sowing and collecting the same after harvest will also help the grower to increase the area under this useful food crop.

Natural crossing in Cumbu Pennisetum typhoides Stapf. and Hub.

By

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Cumbu or *Bajra* is the second important millet of Madras coming next to sorghum. It occupies an area of 2·6 million acres in the Presidency and produces an outturn of 6,85,5000 tons of food grains annually. The natural crossing in cumbu was studied with a view to evolve high yielding hybrid strains in the crop, as a first step in it.

The ear of cumbu is a compound cylindrical spike whose length varies from 8″ to 15″ with a thickness of about one inch to 1½ inch according to the varieties. The spikelets are commonly in clusters of two. In each spikelet there are two flowers. The third lemma bears a male flower and the fourth lemma bears a hermaphrodite flower. The most peculiar feature of the floral mechanism in cumbu is its protogyny. In the progress of flowering, the emergence of the stigma proceeds from apex to the base. This process is completed within three days. On the fourth day the anthers of the hermaphrodite flowers (whose stigmas had already emerged) start protruding and shedding their pollen. This wave also starts from the apex of the head and proceeds similar to the stigmatic wave and is completed in about three days. Finally the anthers of the male flowers of the third lemma start a secondary wave of a pollen supply and complete the work of pollination in three days.

The inflorescence of cumbu, in the stigmatic stage, whose period is about 3 days, courts cross pollination, the extent of which depends upon the availability of foreign pollen. After the three days period, the anthers of the same flower start shedding their pollen and the chances of cross pollination are then reduced to the minimum. With a view to take advantage of this floral mechanism which favours cross pollination, in the evolution of hybrid strains of cumbu, the intensity of natural crossing in this crop was studied at the Millet Breeding Station, Coimbatore, together with the methods by which crossing in nature could be intensified. In the monsoon season of 1948 (September to December) an experiment was laid out with the following variations to estimate the extent of cross pollination that takes place in this crop, under each treatment. The two selected parents were sown under the following conditions (the progeny of the plant selected to serve as pollen parent is designated as the "male line", while the stigma parent as the "female line"):—

1. *Interval of time:* The two parents were sown in adjacent lines (two links apart between the lines) on (a) the same day, (b) with an interval of three days between the sowing of parents, (c) 5 days interval and (d) 7 days interval. The object of this treatment is that the earlier sowing of the pollen parent may facilitate the synchronisation of the emergence of the anthers of the male with that of the stigmas of the female and help in obtaining greater amount of crossing.

2. *Interval of time and space:* (a) Parent lines one link apart sown on the same day, at 3 and 5 days interval and (b) lines 4 inches apart sown on same day, at 3 and 5 days interval.

3. *Shaking the male lines:* The plants in the male lines were shaken several times in the day to facilitate the shedding and free dispersal of pollen. This was tried in sowings done on the same day, 3 and 5 days interval between parents.

4. *Seeds of both the parents mixed and sown in the same line:* The seeds of both the parents were mixed in the proportions of female to male 1 : 1, 1 : 2 and 1 : 3.

5. *Artificially pollinated:* This was done by bagging the heads in female lines and hand pollinating them with pollen from the plant from the male line morning and evening for 3 days till the anthers of the female began to emerge. No emasculation was attempted. This treatment was used for comparison.

The pollen parents that were used in the experiment had the dominant purple colour in the vegetative parts. The female lines were harvested and the seeds from them were sown in beds. Counts of purple plants that appeared were taken and the percentage of out-crossing which took place was estimated as presented below:

Extent of Natural Crossing in 1948 (Rainfed crop)

Treatment		Percentage of amount of natural crossing obtained (Average of 2 replications)
1. Interval of time (parents sown in alternate lines)	Sown same day	77·8
	,, 3 days interval	64·7
	,, 5 days ,,	41·4
	,, 7 days ,,	38·9
2. Interval of time and space (Parents sown in alternate lines)	(a) 1 link apart	
	Same day	69·9
	3 days ,,	54·2
	5 days ,,	32·4
	(b) 4 inches apart	
	Same day	27·7
	3 days ,,	27·3
	5 days ,,	38·0
3. Shaking plants in male lines to shed pollen (Parents sown in alternate lines)	Same day	55·1
	3 days ,,	42·1
	5 days ,,	52·6
4. Seeds of both the parents mixed and sown (in same lines (proportion of female to male)	1 : 1	59·6
	1 : 2	45·4
	1 : 3	75·7
5. Artificially crossed by hand pollinating the stigmas, without emasculation.		88·3

The season was normal for the cumbu crop throughout its growth. In group (i) where interval of time was introduced, the sowing of the parents on the same day gave the highest amount of natural crossing,

being 77·8%. The female parents sown in alternate lines, 2 links apart with intervals of 3 days, 5 days or 7 days in the plot after the male lines were sown, were crowded out by the male lines and they made very poor growth. Moreover, as there were several tillers which were later than the main tillers, there did not appear much point in adjusting the sowing so as to synchronise the emergence of anthers and stigma in the two parents in the group of treatments (2) where intervals of time and space were introduced the closer spacing of 4 inches between lines did not show any advantage. The closer spacing gave poorer plants. In this group also sowing them on the same day was better. In treatment 3, the shaking of plants in the male lines did not improve matters. The cumbu plants shake with every little wind and shed the pollen easily. It did not require artificial shaking to accentuate it. In treatment 4, the 1 to 3 mixture, gave 75·7% cross pollination and the equal mixture gave 59·6%. From the practical point of view, plants intended as be adopted only when it is possible to recognise the plants intended as male parents and eliminate them in the harvest. In treatment 5, artificial pollination, a crossing of 88·3% was obtained. This is the ideal that could ever be possibly reached in this crop.

The data presented above are from the main season of 1948. The experiment will be repeated in the coming season. In the evolution of hybrid strains in cumbu the extent of natural crossing plays an important part, because the percentage of hybrid seed in the "hybrid strain" evolved depends on it. The hybridisation between the chosen parents will be left to nature. This method of work is somewhat different from the hybrid maize work where cent percent crossing could be obtained owing to the monoecious nature of maize, while in cumbu the hermaphrodite nature of flower makes it impossible to eliminate self pollen, and the only help that could be obtained is the protogynous nature of the cumbu flowers.

Summary: The extent of natural crossing in cumbu (*Pennisetum typhoides*) was determined at the Millet Breeding Station, Coimbatore, in the monsoon season of 1948 under different lay-outs of sowing of the parents. The amount of crossing varied from 27% to 8·% according to the treatments. The higher amounts of crossing were obtained by sowing the parents in adjacent lines 2 links apart on the same day (77·8%) and also by mixing the seeds of the parents in the proportion of one female to 3 male (75·7%). This study was undertaken with a view to produce hybrid strains of cumbu in which natural crossing will be the factor in hybridisation. The work will be different from that on hybrid maize owing to the differences in the floral structure of the two plants, as maize is monoecious while cumbu is hermaphrodite. The only help is the protogynous nature of cumbu flowers.

A preliminary note on the statistical analysis of the maximum temperatures at Coimbatore

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&

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Introduction: "Climate and weather are as decisive in the development of a plant as home surroundings are in the life of a growing child" (5). The truth of this statement can be understood well if temperature, moisture and light having maximum influence on plant life, are analysed for their relative importance, individually as well as collectively. Every Agricultural worker knows that these three factors always work together to produce a given effect.

It is proposed to confine the discussion in this paper only to *temperature* and its influence on plant growth. Temperature has got both direct and indirect effects on the performance of a plant, directly by affecting its physiological process and indirectly by the spread or inhibition of its diseases. The killing effect of low temperatures, stem lesions and plant diseases caused by excessive heat, diseases due to low temperatures and sun-scalds, and winter-injuries of fruit trees are some of the well-known instances of the influence of temperature on plant growth. It may even go to the extent of controlling duration and seasonal growth habits in some of the cultivated cereals, as for instance, wheat.

Since temperature is an important weather factor controlling the growth and yield of cultivated crops, the statistical analysis of the daily maximum temperatures recorded at 0822 hours in the observatory attached to the Agricultural College & Research Institute, Coimbatore for a period of 36 years (1913 — 1948 both inclusive) has been taken up for detailed study.

Statistical Analysis: (i) The monthly means of maximum temperatures and their corresponding standard deviations and coefficients of variability were evaluated and are given in Table I, season-war. (ii) The twelve inter-monthly correlations with their corresponding standard errors are given in Table II. (iii) (a) Since the correlations between the monthly means of maximum temperatures of ***February and March & September and October*** are positive and significant, the weekly means of the maximum temperatures of these four months were studied in detail. Table III contains the weekly means of maximum temperatures and their Standard

Deviations and Coefficients of Variability. (iii) (b) The correlations between the various weekly means of temperatures of these four months and their corresponding regressions and nature of significance were worked out. At the beginning of summer, the inter-weekly correlations were found to be highly significant, practically throughout February and March. The possible explanation to the existence of this high positive correlation is the ideal weather condition created by clear skies, feeble air movement and absence of clouds and precipitation', characteristic of the beginning of the summer season. In regard to September and October correlations unexpected weekly combinations of significance were noted and assigned to the onset of the north-east Monsoon.

Interpretiation and Inference: (i) *Table I. Monthly means of maximum temperatures, their standard deviations and coefficients of variability,* (a) Maximum temperature is highest in April and lowest in December. (b) Summer commences in February and lasts upto May. The steady and low value of standard deviation and coefficient of variability for the months of February, March and April indicate that during the summer season, fluctuation in maximum temperature is negligible,

The co-efficient of variability varies from 1·41 to 5·44. It is highest in May, followed by that in June indicating thereby the unsteady nature of weather and the setting in of the south-west Monsoon. Its behaviour is similar in October and November, showing thereby that the north-east Monsoon is commencing. Sudden rise in January points out the withdrawal of the north-east Monsoon.

During the monsoonic periods, May–June to September and October–November to beginning of January, the changes in the co-efficient of variability are very sharp, due to the uncertain weather conditions characteristic of these two main rainy seasons at coimbatiore.

(ii) *Table II. Inter-monthly correlations and their significance.* (a) Barring the two combinations, namely, February–March and September–October, all the other ten inter-monthly correlations are not significant. (b) Towards the end of summer and at the time of the commencement of the south-west and north-east Monsoons and during the north-east Monsoon period, negative correlation exists thereby indicating the approach of the unsteady weather conditions.

(iii) *Table III Weekly means of maximum temperatures and their standard deviations and co-efficients of variability (February, March, September & October).* (a) The steady rise of the weekly maximum temperatures during the months of February and March is a characteristic feature of the commencement of the summer. (b) The fairly uniform mild rise in the weekly means of maximum temperature in September

and slow decrease in the weekly means of maximnm temperature in October point out the setting of the monsoonic weather conditions. (c) In October first week (September 29th to October 5th), co-efficient of variability is maximum, thereby indicating the setting in of the north-east Monsoon. The fairly high and uniform co-efficients of variability in the third and fourth weeks of October confirm that the north-east Monsoon has become steady.

Summary and Conclusion,

1. The nature and types of the correlations, both monthly and weekly, have been analysed in detail. 2. When data for a further period are collected, regression equations can be worked out to forecast the maximum temperature in a particular week based on the knowledge of the maximum temperatures prevailing the weeks preceding. The value of such a forecast is too well-known, particulary to an agriculturist, who is always noted for his eagerness to know the weather conditions in advance. 3. Summer commences in February and lasts upto May. During this period, fluctuation in maximum temperature is found to be negligible. This information regarding the duration and severity of summer at Coimbatore will be of immense use to the farmers of Coimbatore for adjusting suitably their cultural operations. 4. The following details regarding the periods of onset and withdrawal of the two main Monsoons at Coimbatore are brought to light by this preliminary analysis: (a) South-West Monsoon sets in June and continues upto September. (b) North-East Monsoon commences in October and withdraws in January.

Acknowledgment: The authors of this short note are highly thankful to all those who have been responsible for the collection of the meterological data, forming the basic material for this paper.

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TABLE I.—36 Years Data.

Serial No.	Name of the month	Monthly Mean Max. Temp. °F	Standard Deviation S. D.	Co-efficient of Variations %
	Hot Weather Period.			
1.	February	90·1	1·85	2·05
2.	March	94·8	1·74	1·83
3.	April	95·7	1·70	1·77
4.	May	94·5	5·14	5·44
	S. W. Monsoon Period.			
5.	June	88·7	4·24	4·78
6.	July	86·4	2·81	3·25
7.	August	87·6	1·54	1·76
8.	September	89·1	1·99	2·23
	N. E. Monsoon Period.			
9.	October	87·5	2·41	2·76
10.	November	84·5	2·23	2·63
11.	December	83·6	1·18	1·41
12.	January	85·1	2·07	2·44

TABLE III.—36 Years Data.

Serial No.	Details regarding the week	Weekly Mean Max. Temp. °F	Stand. Dev. S. D.	Coeff. of Var. %
	Commencement and early part of summer: Feb. — March.			
1.	Feb. 1st week 1 to 7 ...	88·1	3·68	4·17
2.	,, 2nd ,, 8 to 14 ...	88·8	4·52	5.09
3.	,, 3rd ,, 15 to 21 ...	90·7	4·41	4·86
4.	,, 4th ,, 22 to 28* ...	91·5	4·80	5·25
5.	March 1st week 1 to 7 ...	93·0	3·07	3·30
6.	,, 2nd ,, 8 to 14 ...	94·3	2·65	2·81
7.	,, 3rd ,, 15 to 21 ...	95·0	3·97	4·18
8.	,, 4th ,, 22 to 28 ...	95·5	4·30	4·51
	Commencement of North-East Monsoon: Sept. — Oct.			
9.	Sept. 1st week 1 to 7 ...	88·9	3·89	4·37
10.	,, 2nd ,, 8 to 14 ...	89·1	2·75	3·08
11.	,, 3rd ,, 15 to 21 ...	89·4	3·89	4·35
12.	,, 4th ,, 22 to 28 ...	89·5	3·94	4·40
13.	,, 29th to Oct. 5th (Oct. 1st week) ...	88·7	6·62	7·47
14.	Oct. 2nd ,, 6 to 12 ...	88·5	4·35	4·91
15.	,, 3rd ,, 13 to 19 ...	87·6	5·66	6·47
16.	,, 4th ,, 20 to 26 ...	87·1	6·18	7·10

* In leap years, February 4th week covers 8 days.

TABLE II.

Correlation between the monthly means of maximum temperatures—Agricultural College and Research Institute, Coimbatore.

Serial No.	Details of the correlations worked out		Corr. coeff. r.	Stand. Error S. E.	Corr. significant or not
1.	Between Jan. and Feb.	...	+0·2695	0·1651	No.
2.	„ Feb. and March	...	+0·3939	0·1576	Yes.
3.	„ March and April	...	+0·2286	0·1669	No.
4.	„ April and May	...	—0·0319	0·1714	No.
5.	„ May and June	...	+0·2296	0·1669	No.
6.	„ June and July	...	—0·0079	0·1715	No.
7.	„ July and August	...	+0·2757	0·1648	No.
8.	„ Aug. and Sept.	...	+0·2020	0·1680	No.
9.	„ Sept. and Oct.	...	+0·4639	0·1519	Yes.
10.	„ Oct. and Nov.	...	—0·1128	0·1704	No.
11.	„ Nov. and Dec.	...	—0·0212	0·1716	No.
12.	„ Dec. and Jan.	...	+0·1803	0·1687	No.

Gardenland cultivation around the Agricultural College, Coimbatore

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Nowhere else can we find such a sudden and spectacular improvement in the expansion of gardenland cultivation, i. e. farming under well irrigation, as in the Coimbatore district, in recent years. A large area under dry lands have been converted into gardenland by sinking new wells. Starting with a small nucleus gardenland holding, many have acquired, consolidated and enlarged their holdings. Neighbouring drylands have been purchased, often at high prices and added to their holdings. Old wells have been deepened and widened, if the water supply is promising. Investments of Rs. 5,000/- to Rs. 10,000/- per well is not quite uncommon in this district. It is the advent of cheap electricity from the Hydro Electric Power Scheme of Pykara, some fifteen years

ago, that has greatly accelerated the pace of gardenland cultivation. It has given a great fillip to the sinking of new wells, wherever underground water resources justify it, in addition to the deepening and widening of old wells, introduction of improved implements and machinery and the liberal application of manures.

This phenomenal development in such a short period is entirely due to the quick distribution of hydro electric power and the centre of all improvements has been the installation of electric motors and centrifucal pumps for irrigation purposes. It is wellnigh impossible to bring about these improvements in cultivation with bullock power alone. Wells in Coimbatore are deep and rocky the supply of water would usually go down during the summer. Even installations of oil engine pumps cannot be as handy as these electric motors, as these admit of shifting of the installation to temporary beds at different heights. This district is credited with having nearly fifty per cent of the electric motors in agriculture in the whole of Pykara Electricity Scheme and no persuasion was necessary, especially after World War II when the cost of bullocks and feeding stuffs went up enormously. In fact during the war and post-war periods, a large number of applications for the installation of electric motors had to be kept pending, owing to difficulties of getting transformers and electric materials. More and more deepening of wells in order to get a copious supply of water, affect the other wells of the neighbouring holdings with the result that many of these shallower wells in the course of time become derelict. This happens as underground water is devoid of any natural springs in this area. Such difficulty may be overcome by suitable legislation, directing payment of compensation for the loss incurred. Pumping with electric motors has taken off the very heavy strain on bullocks in lifting water from deep wells, resulting rapid deterioration of the animals. Now pairs do only ploughing, carting and other work on the farm and this has improved the condition of animals very much. This has also reduced the number of pairs required to be maintained on the farm, in addition to the reduction of areas devoted to the growing of fodder at the expense of food and commercial crops.

Incidentally this has induced the farmers to take up to improved methods of agriculture. Already improved tillage implements are being adopted in most of the farms. Several types of soil inverting iron ploughs are used in this district in the cultivation of gardenland crops. In the cultivation of cotton and also for sugarcane, the ridge plough is very commonly used for forming ridges as it is definitely cheaper than getting the work done with manual labour, at the rate of 8 to 10 men per acre. The bundformer is even more popular and economical in the cultivation of summer cholam and ragi cultivation in forming bunds or beds, thus saving a lot in labour costs. What would ordinarily cost by employing

20 men for 4 acres at a cost of Rs. 30/- can be easily done with one pair, one men with four more men to correct them on four acres a day costing in all about Rs. 10/-. The Junior Hoe is another useful implement used in the inter-cultivation of cotton for effective weeding. These implements facilitate quicker operations and cover a larger area and thus effect a large saving in manual labour.

Heavy manuring is a characteristic of this type of cultivation in the Coimbatore district. Application of municipal compost and tank silt from nearby tanks to increase the fertility of the soil is a common practice, in addition to the application of cattle manure from their own farmsteads. Application at the rate of 100 to 200 cartloads per acre is not unusual. Such heavy manuring is done once a year for the cereal crop that is grown first. Chemical manures are rarely used for manuring round the college for gardenlands.

A readiness to try new and improved strains of millets and cotton evolved by the department is another notable feature among these ryots. Strains are so selected to suit the rotations followed by them without much overlapping of crops. The larger gardenland owners have an effective command over labour; the wages paid are not higher than the market rate nor the hours of work smaller. The labourers are even prepared to work a little longer or receive slightly lower wages in these bigger farms, in view the continuity of work which the farm provides throughout the year. This is possible in diversified farming on large blocks of gardenland. Permanant farm servants are alloted more responsible work and are given free quarters in the farm, with sundry perquisites on festive occasions.

The common rotation followed is growing of two or three crops in a year. The cropping is so adjusted to have two cereal crops, one for cattle and the other for human beings and one money crop. The climatic conditions in the district are also such as to facilitate such rotations. Unprecedented increases in prices after war, have not only made these ryots rich, but also have enabled many of them to save up something for the future. The main cultivating classes are the Kammava naickers and Vellala gownders who are closely in touch with agriculture, in spite of their other avocatious. Some of the land-holders earn large incomes from non-agricultural sources also and are able to invest in purchasing, consolidating and enlarging their holdings. Such an expansion of area under gardenlands would not have happened but for the keen interest in investing their money on land to get better returns by various improved methods.

A number of holdings around the college were enquired into, to find out their earnings during the year and their approximate income and expenditure are tabulated below :—

Table showing Income and expenditure per acre of cultivation of three holdings

	Holding No. 1 11 acres - one pair 2 permanent coolies 11 acres Ragi and 11 acres Cotton	Holding No. 2 6 acres - and 1 acre wetlands. 2 pairs and 3 permanent coolies. 3 acres Ragi and 3 acres Cholam and 6 acres Cotton	Holding No. 3. 11 acres and $1\frac{1}{2}$ pairs and $2\frac{1}{2}$ permanent coolies Ragi 5 acres and Cholam 5 acres and Cotton 10 acres
Expenditure			
Ragi	227	187	172
Cholam	...	110	127
Cotton	69	66	62
Total	296	363	361
Income			
Ragi	296	265	292
Cholam	...	363	362
Cotton	860	625	730
Total	1156	1253	1384
Less cost of maintenance of pairs and permanent coolies per acre owned.	190	356	173
Nett income ...	670	534	850
	Average ...	685/-	

Note :— Holding No. 2 has additional income by sale of milk and milk products. About Rs. 350/- per year from one acre of paddy is also obtained by holdings No. 2 and 3. Maintenance of pairs is worked at the rate of Rs. 2—8—0 per day and the yield is valued at the controled rates. Depreciation on the capital investment is not included.

Holdings around the college are managed entirely by the members of the family. New methods of cultivation are sought after and practised in a manner that would strike any student of agriculture with amazement. On an average a cultivator gets about Rs. 685/- from three crops grown in one acre of land. As this is quite a substantial amount it is no surprise to see that the gardenland cultivator is often very much better off than his neighbouring dryland or wetland cultivator. They generally maintain a higher standard of living. The prosperous state of the gardenland areas of Coimbatore is obviously due primarily to the fact that the farmer has an assured and copious supply of water all through the year for growing a variety of crops and it is this which has induced the Government of Madras to launch out on the well-subsidy scheme for digging more wells and thereby improve crop production.

Economic Planting of Rice

Transplanting is the normal practice obtaining over the larger part of the area under irrigated rice. Fourfifths of the rice grown in the world is transplanted and almost all countries like Spain, Italy, Japan etc., where the highest acre yields of rice are recorded adopt transplanting. The fact that the yield per acre is increased by transplanting is well recognised.

For a long time past the Agricultural Department has been advocating the economic methods of transplanting rice, by the reduction of the seed rate usually adopted. Sturdy seedlings tiller better producing larger earheads. Sturdy seedlings can be raised only by thin sowing of the nurseries. Thin sown nursery produces a better type of seedlings, than in a thick sown nursery. Their early vigour is reflected in a higher yield. Experiments at most of the Rice Research Stations, Samalkota, Maruteru and Coimbatore over a number of years have shown definitely that the crop grown from thin sown nursery always gave increased yield ranging from 6 to 15 percent, compared to the crop raised from thick sown nursery. The Common practice is to sow thick using 7½ to 12 lbs. of seed paddy for each cent of nursery and raising about 5 cents of nursery for planting an acre of the field. Some seeds do not germinate, while some that germinate lag behind in growth. The nursery is over-growthed and the seedlings grow lanky and matted together. The women who transplant have a certain "feel" of the thickness of the bunch of seedlings they hold between their fingers, plant only that number of seedlings that give them that correct "feel". Counts have shown that there are as many as 20 seedlings per bunch thus planted. Associated with thick sowing there is a tendency always for the women to plant in bunches wide apart.

In the economic method of planting advocated by the Department only 3 lbs. of seeds are required for sowing in one cent of nursery, 7 to 8 cents of nursery are required for providing enough seedlings per acre in the case of medium duration varieties or 10-12 cents for Kar varieties. The seedlings grown in such thin sown nurseries are robust and thick and fewer number of them give the required "feel" for the transplanting. Generally, for medium and long duration varieties 6"—8" spacing between the plants and for short duration kar varieties 4"—5" spacing is the optimum. Compared with the common practice of thick sown nurseries, the method of economic planting with a reduced seed rate advocated by the Department gives a saving of at least 25 lbs. (10. m.m.) of seed per acre. By adopting the reduced seed rate over the 10 million acres of paddy in the Province, there will be a saving of nearly a lakh of tons of paddy seed. By this simple improvement in cultural practice in Tanjore District alone, there will be a saving in seed paddy that would be enough to feed its entire population for three weeks. Thus sowing thin in the paddy nurseries, besides giving a definite increased yield assures immediately an appreciable saving in seed. (From the Director of Agriculture).

Agricultural News Letter

Rust Resistant Strain of Korra. The Korra crop in the Ceded districts is invariably susceptible to the disease known as *rust*, characterized by rusty brown spots on the leaves. In certain seasons, when the intensity of the disease is high, the yield of the crop is considerably reduced. A selection S. I. 3756 evolved at the Millet Breeding Station, Coimbatore, has been found to comparatively resist the

disease better than the local. Tests that were conducted for the past three seasons in the Bellary district have conclusively proved its suitability to resist the disease and yield higher than the local. Seeds of this strain can be had from the Superintendent Agricultural Research Station, Hagari (Bellary District).

Improved Strain of Irrigated Cholam. A high yielding strain, K. 2, has been found suitable for cultivation in the two seasons–January,–February and April May, in Tirunelveli district. The strain is short in height and matures earlier than the local by about 10 days. The ear-heads are medium sized and compact with well-set white pearly grains. The cultivation of the strain not only saves the cost of one irrigation but also gives extra produce valued at Rs. 37—8—0 per acre at the present price of cholam.

New Ragi Strain. K. 1. ragi yielding 18 per cent over the local (288 lbs. per acre) isolated at the Agricultural Research Station, Koilpatti, is now available for distribution. The new strain resembles the local in respect of duration ear-head etc., and at the present price of ragi, a net profit of Rs. 36/- per acre is expected out of its cultivation.

Hybrid Cumbu. Two new hybrid cumbu varieties X. 1 and X. 2 were recently released for trial from the Millet Breeding Station, Coimbatore. They have been produced by crossing promising pure lines which exhibited the maximum hybrid vigour when crossed. District trials, conducted in Tiruchirapalli district in the Musiri and Perambalur taluks have been very encouraging. Extensive trials are being arranged in the coming season to find other areas suitable for cultivating the hybrid cumbu X. 1 and X. 2.

Advice to Fruit Growers. Malta, Nepali oblong, Italian, Rajahmandry and Lucknow seedless are the most promising varieties of lemons, which commence to bear within two years of planting. Layers of these varieties are produced on a large scale at the Government Fruit Nursery, Kodur and at some of the Agricultural Research Stations in the Province. About twenty reputed mango varieties introduced for trial from North, Central and Western India, failed to fruit even after ten years of planting at the Fruit Research Station Kodur in the Cuddapah district. Efforts made to induce them to flower by adopting devices such as ringing the trunk and their branches and smudging the trees did not prove successful. The fruit growers of this Province are therefore advised not to introduce for commercial planting fruit varieties from other parts of India, however high their reputation may be, in their native habitat, but plant only varieties of known performance tested by the Agricultural Department.

Green Manure. An acre of paddy field requires 25 to 30 lbs. of small sized green manure seed like Pillipesara, *Sesbania speciosa* etc. Efforts to produce seed of this green manure crop on the paddy field bunds at the several Agricultural Research Stations show that it is easily possible to obtain 25 lbs. of seed from *Sesbania speciosa* planted on the well-trimmed field bunds of an acre of land immediately after planting paddy in July-August. Planting of seedlings is to be preferred to dibbling seed directly on the bunds. Nursery of *Sesbania speciosa* should be sown on a small high level plot four to five weeks in advance of the completion of paddy planting in one's holding. The plants grow quickly and commence to flower in November. Pods ripen by middle of January.

Coconut Seedlings. In order to supply the public with selected seedlings at comparatively low price, a comprehensive coconut nursery scheme financed by the Government and the Indian Central Coconut Committee was sanctioned by the Government of Madras in October 1948, and was put into operation from 10th

November 1948. Eight nurseries have been started at the eight research stations, viz., Anakapalle, Samalkot, Maruteru, Tindivanam, Pattukottai, Coimbatore, Pattambi and Nileshwar. Under this scheme, it is proposed to produce annually 160,000 seedlings to plant about 2,000 acres. Seednuts from selected trees having all the desirable characters will be collected mainly in the months of February to June and the supply of seedlings will commence from July and continue throughout the monsoon months.

Quality in Fruit Products. To prevent a large number of spurious and synthetic fruit drinks with little or no fruit in them but with plenty of essences and brilliant colours being sold under false labels and passed off as first class and real fruit juices, the Fruits Products Control Order, 1948, has been brought into force by the Government of India. Under this order, it is necessary for a manufacturer to possess a licence before opening any fruit preservation concern, and the products manufactured have to conform to certain standards. The Bio-chemist, Government Fruit Products Research Laboratory, Kodur, who is in charge of this order will give guidance and advice to manufacturers already in the field and those proposing to start new concerns.

Pith formation in Sugarcane. Sugarcane stem is generally solid in structure made up of mostly soft tissues full of sugary juice. Under certain conditions of cultivation and weather, the stem forms hollows in the centre or the stem may be composed of dried up non-juicy tissue. Such deterioration in cane is termed as pithiness in sugarcane. This will result in a loss in tonnage of cane and sugar. Hollowness or cavity pith in the stem is generally formed at the base and it spreads to the top. The dried up tissue or corky pith is formed at the top only. Pith formation leads to poor juice quality and low recovery of sugar besides low extraction percentage. Pith formation is a varietal character. C. O. 527 forms large amount of corky pith at the top; C. O. 449 and C. O. 349 form large cavity at the bottom and Pith formation in C.O.419 is comparatively low. Application of a large dose of Nitrogen, arrowing (shooting into blossom) or flowering, too frequent or copious irrigation or raising the crop under swamp conditions and continuous ratooning encourages pith formation. Pithiness also developes when cane is not harvested at the optimum stage of ripeness.

Preservation of Seed Potatoes. Seed material from the main crop of potatoes on the Nilgiris develop several long sprouts and shrink very much in long storage. The development of long sprouts are disadvantageous as they use up a fair proportion of the reserve food. They also break easily while handling. "Fusares" a Bayer Product, brings about the inhibition of the sprouting when dusted over the seed tubers soon after harvest and the treated tubers remain firm and the sprouts are short. One pound of dust is sufficient to dust two hundred-weights of seed.

DDT and Benzone Hexachloride. Recent investigations have shown that it is possible to control most of the insect pests by a judicious use of either Benzone Hexachloride or DDT. DDT either as a 5 per cent dust or O.1 per cent spray and that it is a specific for jassids on bendai, brinjal, cotton and paddy. The spray was found to have a salutary effect against the pests of cruciferous plant also. Yet another interesting finding about DDT is the control of Agathi weevil. This is a serious pest in Betelvine gardens against which we were till now practically helpless. Dusting with DDT 5 per cent was recently found to cause over 90 per cent mortality. The owners of betelvine gardens are so convinced of the beneficial effect of this treatment that they are now coming forward to have their entire infested gardens treated. The betelvine bug is another major pest of the garden. The same chemical was found capable of decimating this pest also. Benzone Hexachloride has specific action against some other insect pests. The dust was found effective against striped bug of paddy.

Disease Position in the Province. A case of plant poisoning was investigated at Kollegal taluk of Coimbatore district. The village affected was Kamakarai about 10 miles from Kollegal situated on the border of the hills. It was reported that a batch of fifteen animals belonging to two owners died suddenly within half an hour after eating a wild variety of grass called "Kagayanagallu" in Canarese. The plant resembles elephant grass, growing upto 4½ to 5 feet in height. Animals exhibited shivering, salivation, giddiness, rolling of eyeball, dilatation of the pupil, tympany prostration, struggling and death. Since the symptoms were highly suggestive of Hydrogen cyanide, samples of grass were sent to the Government Analyst, Guindy and the Research Officer, Toxicology Section, Medical College, Madras both of whom confirmed the findings as positive for Hydrogen Cyanide".

Artificial Insemination. In May 1949 the number of animals inseminated was 85. Five calves born by Artificial Insemination were verified. In June 1949, the number inseminated was 45 and the number of calves verified was 5.

Research Notes

In the crop-weather data collected in 1948—49 in regard to the two varieties of cholam, viz. Co. 1 (Periamanjal) and Co. 3 (Talaivirichan), grown side by side, it appears that Co. 3, inspite of its tillering habits, has got the capacity to utilise the soil moisture in a more economical manner than Co. 1.

Fortnightly soil samples at three different depths in the portions of the same field occupied respectively by these two strains were taken for assessing, in duplicate, the moisture contents. The mean of the averages of the soil moisture data as percentage are presented hereunder—'depth-war',—with reference to each important growth phase of these two varieties of cholam :—

S. No.	Details of the growth phase	Depth at which the soil sample is taken						Total rainfall in inches during the period	Acre yield in lb.			
		3"		6"		12"			Co.1		Co.3	
		Co.1	Co.3	Co.1	Co.3	Co.1	Co.3		Grain	Straw	Grain	Straw
1.	Sowing to flowering (3—8—1948 to 15—11—1948).	6·35	6·96	9·63	10·74	12·40	14·25	2·75				
2.	Flowering to ear formation (16—11—1948 to 31—12—1948)	10·27	10·96	10·58	10·79	13·40	14·59	2·78	114	2544	124	2707
3.	Seed maturing stage (1–1–1949 to 25—1—1949)	4·04	4·53	6·90	6.47	10·85	9·64	Nil.				

If the water requirements of these two strains of cholam are similar, there should not be any difference between the moisture contents at everyone of these stages and that too in regard to each depth. In the first two phases of growth, Co. 1 seems to have consumed more soil moisture than Co. 3; but in the third phase of growth, Co. 3 looks like requiring more soil moisture, particularly from deeper

layers, than Co. 1, perhaps for meeting the needs of its physiological processes at the time of grain maturity. This is also explainable in one way, namely, the possibility of the variety Co. 3 having more ears than the number of plants due to its inherent habit of putting forth side shoots when once the survival of the main shoot becomes an uncertainty due to "Dead Hearts". The experiment is being continued with these two strains of cholam and further observations in regard to this aspect will be recorded.

The facilities given by the Central Farm authorities and the Millet Specialist for the conduct of the experiment and the Government Agricultural Chemist for the soil moisture estimations are gratefully acknowledged.

Agricultural Meteorology Section, Coimbatore 28th September, 1949. } C. BALASUBRAMANIAN.

TWO POTATO CROPS FROM ONE TUBER.

The temperate and equable climate of Nilgiris is suited to raise three crops of potatoes in one year namely irrigated, main and second crop. The usual method is to plant whole tubers. At the time of harvest these tubers which are known as mother tubers can be found as a shrunken mass of tissue. They are generally unfit for any further use and hence are usually thrown away. While harvesting the irrigated crop of 1949, a few mother tubers were found to be quite healthy, and well filled, unlike the usual shrivelled remanants. These were replanted during the main crop season of 1949 to find out whether they would yield again. It is surprising to note that these tubers not only gave another crop but gave also a fairly good yield. The yieds are given below :—

Variety	Mother Tuber No.	Yield in ozs.		
		Irrigated crop 1949	Main crop 1949	Total
Green Mountain ...	I	8	2	10
Golden Wonder ...	II	4	15	19
Golden Wonder ...	III	3	10	13

This shows that it is possible to raise two crops from one tuber, provided the tuber is healthy at the time of the harvest of the crop.

Agricultural Research Station Nanjanad, Ootacamund, P. O., Dated 6th September, 1949. } M. D. AZARIAH & R. S. ERNEST.

Crop and Trade Reports

Cotton Raw, in the Madras Presidency : The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 to 28—10—1949 amounted to 3,72,581 bales of 392 lb. lint. The receipt in the corresponding period of the preivous year were 3,37,443 bales. 4,88,253 bales mainly of pressed cotton were received at spinning mills and 5,426 bales were exported by sea while 92,623 bales were imported by sea mainly from Karachi and Bombay.

(Director of Agriculture).

Weather Review — For October 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches	Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	20·5	+11·9	37·8	South.	Negapatam	3·5	—7·1	18·7
						Aduturai*	2·9	—4·5	25·5
	Calingapatam‡	9·9	+2·0	33·4		Pattukottai*	5·2	—4·3	96·7
	Vizagapatam	12·5	+4·7	38·8		Mathurai	1·2	—6·2	34.7
	Anakapalle*	14·6	+6·2	47·3		Pamban	4·7	—3·8	15·8
	Samalkot*	12·7	+3·5	45·1		Koilpatti*	6·2	—0·4	19·2
	Kakinada‡	3·9	—4·6	46·1		Palamcottah	2·1	—5·0	15·1
	Maruteru*	15·5	+6·6	48·3					
	Masulipatam‡	3·1	—5·5	40·9		Ambasamudram*	4·8	—1·5	12·8
	Guntur*	5·5	+1·4	37·5					
	Agrl. College, Bapatla*	6·8	—1·9	48·3	West Coast.	Trivandrum	5·9	—4·8	52·9
	Veeravanam*					Fort Cochin	10·5	—2·9	134·9
	(College Farm)	10·4	(x)	48·6		Kozhikode	8·3	—2·8	136·9
						Pattambi*	5·2	—4·3	96·7
Ceded Dists.	Kurnool‡	6·6	+3·4	41·2		Taliparamba*	9·2	+1·0	164·2
	Nandyal*	3·2	+0·2	37·1		Nileshwar*	6·9	+0·8	169·5
	Hagari*	4·3	+0·9	18·5		Pilicode*	4.2	—0·7$	160·0
	Siruguppa*	7·7	+4·2§	30·3		Mangalore	2·9	—4·4	159·5
	Bellary	4·5	+0·3	18·5		Kankanady*	3·9	—3·4	161·6
	Rentichintala	3·3	—1·7	28·7					
	Cuddapah	2·5	—2·4	31·1	Mysore & Coorg.	Chitaldrug	4·3	—0·5	16·7
	Anantharajpet*	5·9	—1·5	40·1		Bangalore	10·3	+4·4	42·0
						Mysore	9·9	+4·0	28·3
Carnatic.	Nellore	1·1	—8·5	35·4		Mercara	6·4	—1·9	120·0
	Buchireddipalem*	3·0	—6·2	29·6	Hills.	Kodaikanal	9·4	—0·8	42·5
	Madras	3·5	—8·5	31·3		Coonoor*	11·9	+1·6	34·9
	Tirurkuppam*	1·9	—9·8$	44·1		Ootacamund*	9·8	+2·0	40·1
	Palur*	3·5	—4·0	28·7		Nanjanad*	13·7	+7·1	47·4
	Tindivanam*	3·1	—4·1	23·0					
	Cuddalore	2·0	—9·5	25·0					
Central.	Vellore	6·5	—0·3	39·0					
	Gudiyatham*	8·2	+1·6	38·6					
	Salem	6·9	+0·5	31·8					
	Coimbatore (A. C. R. I.)*	5·4	—0·6	14·9					
	Coimbatore (C. B. S.)*	4·9	—1·5	15·1					
	Coimbatore	6·5	+0·2	17·5					
	Tiruchirapalli	7·4	+1·1	35·7					

Note:—
(1) * Meteorological Stations of the Madras Agricultural Department.
(2) Average of ten years data is taken as the normal.
(3) x Readings are recorded only from February 1948.
(4) $ Average of six years data for Tirurkuppam and seven years data for Pilicode is given as normal.
(5) § Taluk office normal is 4·0" and rainfall 7·2"
(6) ‡ Incomplete data since the particulars of the last few observations are not available.

Weather Review for October 1949

The month began with a fairly active monsoon along the West Coast. On 4—10—1949 the monsoon withdrew and continental air spread over the whole country, north of Lat. 14°N. Due to a depression noted in the East Central Bay of Bengal on 8—10—49, the activitity of the monsoon was revived to some extent, particularly in Tamil Nadu. Temperatures in the middle of the month were noted to be above normal in the region outside Kerala and South Kanara.

On 15—10—49 conditions became unsettled in the Andaman Sea. Next day they moved westwards into the South-East Bay of Bengal as a low pressure wave and four days hence the conditions in the South Andaman become unsettled. Three days afterwards the unsettled conditions in the Andaman Sea concentrated into a depression and resulted into a cyclonic storm moving in the West-North-Westerly direction.

The depression in the Bay of Bengal, noted on 26—10—49, intensified into a severe cyclonic storm. The severe cyclone in the Bay of Bengal was found to be centred at 0830 hourse I.S.T. on 27—10—49 about 100 miles South. South-East of Cocanada. The next day the cyclone struck the Circars Coast between Masulipatam and Cocanada and on that night became a feeble one. This cyclone caused locally very heavy rain along the Orissa Coast. The month ended with the continuous persistence of a well-marked discontinuity in the South-East Arabian Sea in the Laccadives and of Malabar Coast. The note-worthy falls in the month are given below :—

Date	Place	Rainfall in inches
8—10—1949	Pamban	2·0
9—10—1949	Alleppy	2·3
10—10—1949	Cochin	3·4
,,	Nagpur	2·2
15—10—1949	Vellore	2·0
17—10—1949	Salem	2·7
18—10—1949	Kurnool	2·3
22—10—1949	Tiruchirapalli	2·6
26—10—1949	Kozhikode	2·6
27—10—1949	Calingapattam	3·3
28—10—1949	Palakonda (Vizagapatam Dt.)	6·0

Monsoon Rainfall Summary June to September 1949

Season as a whole: "Though the monsoon arrived unusually early, it did not advance beyond the West Coast of the Peninsula during June and it got established in North-East India only at the end of the month. However, within the first ten days of July, it rapidly advanced over the whole country and remained fairly active giving well-distributed rain over most regions till the middle of August. There was a marked slackening in the activity of the monsoon over many regions during the second half of August. During the first fortnight of September, it was active to strong in most parts of Northern India and the central parts of the country while during the third week it was very vigorous in the South Circars, the Deccan and the Konkan. The monsoon withdrew from North-West India and the West United Provinces after the 19th September and from the rest of take country by the 3rd of October. Taking the period as a whole, the rainfall was normal or in excess over the country expect in Orissa and Madhya Bharat where it was deficient. Averaged over the plains of India, the rainfall for the season was 5 percent in excess." [Extract from the supplement to the Indian Daily Weather Report, dated 18—10—1949]

Agricultural Meteorology Section, Coimbatore, Dated 11—10—1949.

M. B. V. N., C. B. M. & M. V. J.

Departmental Notiftcations — Postings and Transfers

GAZETTED SERVICE

Name of Officers	From	To
Sri Kachapeswara Iyer, S. S.	Asst. Marketing Officer, Madras.	Dy. D. A., Ellore.
,, Natarajan, T.		D. A. O., Chingleput.
,, Seshadri, A. R.		Asst. Entomologist, Coimbatore.
,, Sivaswami, E. G.	D. A. O., Chingleput,	Asst. Marketing Officer, Madras.

SUBORDINATE SERVICE

Achuthan Nambiar, K. — F. M. Wynad Colonization schme, Vaduvanchal to F. M. Nileswhar II; Chathukutty Nambiar, M. — Paddy Asst., to Paddy Asst Seed Development Schme, Tellichery; Gopalan, N. — Asst. in Oilseeds Tindivanam, to A. A. D. Badagara; Hanumantha Rao, M. — Asst. in cotton, Narasaraopet, to A. A. D. Ongole; Jaya Raj, M. V. — Asst. in cotton, Coimbatore to A. A. D. Nilakottai; Kanakaraj David, S. — Asst. Entomologist, Coimbatore to Asst. in Entomology, Coimbatore; Karuppannan, G. — Asst. in Millets, Coimbatore to A. A. D. Gobichettipalayam; Krishnamurthi, J. — Paddy Asst. Coimbatore, to A. A. D. Lalgudi; Krishnamurthi, K. — A. D. Vuyyuru, to A. D. Sugarcane Development Work, Chodavaram; Lakshmaiah, C. — Special A. D. Hospet, to A. A. D. Nandyal; Muthuswami, T. D. — on leave to Paddy Asst. Seed Development Work, Villupuram; Narayanan, N. — A. D. Pattukottai, to A. D. Thiruthuraipundi; Pattabhiraman, R.—A. D. Thiruthuraipundi, to A. D. Pattukottai; Purusothaman, G. — Asst. in cotton, Coimbatore, to A. D. Chidambaram; Ranga Reddi, B. — A. A. D. Nandayal, to A. A. D. Adoni; Ramakrishnan Nambiar, C. Asst. in Oilseeds, Tindivanam, to A. A. D. Ponnery; Ramachandran, K. — Asst. in cotton, Koilpatti, to A. A. D. Tellicheri; Ramadoss, A. — P. A. to D. A. O. Tanjore, to Asst. in Millet, Seed Development Work, Nilakottai; Rama Ratnam, F.M. Sugarcane, Liaison Farm, Kulitalai, to A.D. Cuddalore; Ramakrishnan, S.R. Asst. in Millets, Coimbatore, to A. A. D. Rasipuram; Subba Rao, A. — F.M.A.R.S. Sirugappa, to Asst. in Melon Scheme, Sidhout; Sanjeevi, P. S. — Asst. in Millets, Coimbatore, to A. D. Kulitalai; Viswanathan, M. A. — Cotton Asst., Coimbatore, to A. A. Peruntalmanna; Venkataraman, N. — Asst. in Millets, Coimbatore, to A. D. Ramnad.

APPOINTMENTS

Janab P. Ali, B. Sc., (Ag.) is appointed as upper subordinate and posted as Farm Manager, Wynad Colonization Scheme, Vattuvanchal.

The following I grade fieldmen shown in the annexure are appointed as upper subordinates and are posted to the vacancies shown against each :—

Arasappan, S. — A. A. D. Thirumangalam; Ananthanarayanan, K. R. — A. A. D. Gudiyattam; Devasirvatham, D. — Asst. in cotton Coimbatore; Kunhikannan Nambiar, K. — A. A. D. Calicut; Kadir Batcha, T. N. — Asst. in cotton, Coimbatore; Krishnamoorthi, S. —A.A.D. Mannargudi; Kaliyanasubramaniam, S. Asst. in Mycology, Coimbatore; Narayanan, V. — Asst. in Millets, Coimbatore; Ramachandran, S. — A. A. D. Ambasamudram; Ramakrishnan, S. R. — Asst. in Millets, Coimbatore; Rama Rao, C. V. — Asst. in Paddy, Coimbatore; Somappa Naidu, H. — A.A.D. Palakonda; Thangavelu, D. M— Asst. in millets, Coimbatore; Velmurugan, R. — Millet Asst Seed Development Schme, Coimbatore; Venkataswami, R. — Asst in Millets; Coimbatore; Yeganarayanan, S. — A.A.D. Sankarankoil.

Agriculture College and Research Institute, Coimbatore

LIST OF ADDITIONS TO LIBRARY FOR OCTOBER 1949.

1. AIYAPPAN (A): Report on the Socio-economic Conditions of the aboriginal tribes of the province of Madras. 1948.
2. BRICKLAND (J): Microbiology and man. 2nd Edn. 1948.
3. BURCH (G.I.) & PENDELL (E): Human breeding and Survival; population, Roads to peace or war.
4. COHEN (R.L.) & GUIBLEBAND (C.W.): Economics of Agriculture. 1948.
5. DARLINGTON (C.D.) & MATHER (K.): The elements of genetics. 1949.
6. HERMI INIE (B.K.E.): Diagnostic techniques for Soils and Crops. 1948.
7. HUNTER (W.) & HUNTER (F.R.): College Zoology. 1949.
8. JOGI RAJU: Elementary lessons in agriculture in Telugu. 1949.
9. KNOWLES (F) & WATKIN (E): A practical Course in Agricultural Chemistry for senior students of Agricultural Dairying, Horticulture and Poultry husbandary. 2nd Edn. 1947.
10. KUBIENA (W.L.): Micropedology. 1938.
11. MARTIN (H): The Scientific principles of plant protection with Special reference to Chemical control. 3rd Edn. 1947.
12. MASEFIELD (C.B.): A handbook of Agriculture. 1949.
13. MATHER (M.): Biometrical genetics: their study of continuous. 1949.
14. STAPLEY (J.H.): Pests of farm Crops. 1949.
15. SNYDER (L.H.): The principles of heredity. 3rd Edn. 1946.
16. THOMPSON (La Verne Ruth): Introduction to micro-organisms 2nd Edn. 1949.
17. VAN HOOK (A): Sugar. Its production: Technology & uses. 1949.
18. WADDINGTON (C.H.): Organisers & genes. 1947.
19. WENT (F.W.) & KENNETH (V.): Phytohormones 4th print. 1948.
20. Annual Review of Biochemical and allied research in India, Vol. 18. 1947.
21. Department of Agriculture, Madras: Departmental Manual. 4th Edn. 1949.
22. Proceedings of the 7th meeting of the Animal Husbandry wing of the Board of Agriculture and Animal Husbandry in India. 6th—20th December 1948.

D. B. K.

The Madras Agricultural Journal

Vol. XXXVI DECEMBER 1949 No. 12

CONTENTS.

The Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXXVI December 1949 No. 12

Editorial

Food and National traits: We publish elsewhere in this issue some observations on human behaviour under experimental semi-starvation and subsequent rehabilitation. Nervous tension, emotional instability and irritability were very marked features observed in all the subjects under study. Humour dried up and the tone of the group became very sober and serious. Apathy was very marked, except in relation to food and curious forms of acquisitive behaviour were developed, perhaps as a compensation for food deprivation. During rehabilitation, recovery from apathy was very rapid and gradually social and cultural interests too, reappeared.

This experiment opens up an interesting line of thought, as to how far our chronic food shortage affects our national traits and characteristics. We must admit that as a nation we are rather deficient in the saving grace of humour, and rather too prone to carry ideals to extremes and not sufficiently realistic to tackle our everyday problems in the most effective manner. There is also an irritability which finds expression in a narrow, legalistic approach to all questions of social and cultural advancement. The underlying factor of all these features would seem to be our chronic under-nourishment. The well-known Chinese writer Lin Yutang has suggested in one of his essays, formulae for depicting the national traits of different countries. Thus the Englishman is made up of 3 grains of realism, 2 grains of dreams or idealism, 2 grains of humour and 1 grain of sensitivity, giving a "national formula" of $R_3 D_2 H_2 S_1$. Corresponding formulae for other nations are $R_3 D_4 H_1 S_2$ for the Germans; $R_2 D_4 H_1 S_1$ for Russians and $R_2 D_3 H_1 S_1$ for the Japanese, all these three being deficient in a sense of humour and abnormally high in idealism, which makes them susceptible for dictatorships. The Americans have a formula of $R_3 D_3 H_3 S_2$, more or less similar to the English, but with a higher degree of idealism and sensitivity. As

Lin Yutang points out, the Americans are tremendously enthusiastic nearly all the time about something or other. On the whole, the English would seem to have the soundest national make up, their R_3 making for emotional stability and a realistic approach to all problems and their keen sense of humour enabling them to pull through with a smile, out of all sorts of difficult situations. We Indians have not been a free nation long enough to develop national traits as yet, but if one might be attempted on Lin Yutang's model, it would be R_2 D_4 H_1 S_3. This formula draws attention to our excessive idealism, and sensitivity (what other people would term "touchiness") a deficiency of humour and sense of realism. We have of course a biological explanation for this, in our chronic under-nourishment, but it cannot serve as a justification. The remedy too, is obvious, being nothing less than a concerted drive to improve food production in the country and raise our national dietary from semi-starvation, to an adequate level.

How the Chemistry Section helps the farmer *

By

P. D. KARUNAKAR,
Government Agricultural Chemist,
Agricultural College & Research Institute, Coimbatore.

One of the chief functions of the Chemistry Section is advisory. Practically every day letters are received from ryots of the Province requesting advice regarding soils, manures or waters, manurial requirments of crops, suitability of lands for various crops, reclamation of alkaline soils etc. Advice is tendered based on analysis and on experience. In addition the officers of this and other departments, manurial firms and Indstrialists make use of the section for similar advice which finally reach the farmer. In this connection two to three thousand of what may be termed advisory samples of various kinds are analysed every year. It is fortunate that the section is thus brought in close contact with the problems and the needs of the ryots since it enables the designing of research programmes primarily to attack his day to day problems. How this has worked in actual practice is recounted below :—

Past Work: (a) Rice being the main food crop of the Province, the chief rice areas, namely the deltaic regions of the East Coast, the rainfed rice areas of Malabar and the Periyar Project ayacut in Mathurai were systematically surveyed for their plant food content. Based on the survey, a manurial programme for paddy was formulated for adoption and experimentation in the research stations located within these soil-climatic regions. The manurial trials in these stations, particularly those conducted in the past ten years in the internationally accepted scientific manner bave shown that the manurial programme formulated then was sound. Recommendations are now being made to the ryot regarding the manurial requirments of rice with the confidence engendered by long years of research.

(b) The sudden appearance of alkalinity after a lapse of several years in some of the great project areas, such as Assuan Dam, Sukkur barrage, Nira Velley etc., gave rise to the fear that similar alkalinity may arise in the Tungabhadra Project area also. To settle this question, the area was surveyed and this has enabled us to conclude that due to the presence of a porous *garusu* layer at the lower depths, the rise of salts to the surface on application of

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* Paper read at the 32nd Collage Day and Conference.

water need not be feared. This has been corroborated by the irrigation experiments conducted at the Agricultural Research Station, Siruguppa where no rise of salts was noticed even in wet lands. In addition to this all-important information, the survey has furnished much knowledge regarding the soils of the project area in various other directions, such as depth of soils, their physical, chemical and biological status, etc., all of which are finding their way to the farmers in the locality in the shape of advice.

(c) The newer knowledge of Base Exchange in soils led to the adoption of gypsum and organic matter as the agents for reclaiming alkaline lands in Tiruchirapalli district with great success. Starting from scratch on a land where not a blade of grass grew before, the land was reclaimed within three years and the crop at the end of this period yielded 3,000 lb. of paddy per acre. In view of the occurrence of extensive deposits of gypsum in Perambalur and Ariyalur taluks, this method is recommeded as suitable for the speedy and economic reclamation of alkaline lands especially in the Tanjore and Tiruchirapalli districts. Many enlightened ryots are already adopting this process with advantage.

(d) Experiments with bullocks conducted by the Chemistry Section enabled the formulation of feeding standards for maintenance and for various levels of work such as mhoting, ploughing, carting etc. These recommendations are now being followed in all the Agricultural Research Stations. The adoption of these standards has resulted in much savings in the cost of maintenance of work animals. Some of the enlightened farmers are already taking advantage of the recommendations. Apart from the formulation of feeding standards, the importance of the minerals, Calcium and Phosphorus, has been brought out by these experiments. To-day the mineral mixture has become very popular with the farmer and many of the prominent manure firms carry it as an item of their regular stock.

Present Programme: As in the past, the present investigations are designed with the primary object of benifiting the farmer. The more important items are explained below :—

(e) Investigations are in progress in ryot's fields and in the Agricultural Research Station, Koilpatti, in the Tirunelveli district, with the object of rehabilitation of marginal lands in dry areas on the lines of experience and success achieved by the T. V. A. plan. In brief, the method consists in growing a legume on the

marginal lands with the application of Super-phosphate and the seeds inoculated with their specific root-nodule bacteria prior to sowing. The first flush of the legume crop is utilised as fodder and the second growth is ploughed in. A grain or a cash crop is raised subsequently. This is repeated every year until the cumulative effect improves the productive status of the soil. The success of the plan depends upon adequate rainfall from June to September, not only for the good growth of the legume but also its quick decomposition in the soil when ploughed in.

Last year in the Agricultural Research Station, Koilpatti, the legume gave only about 500 lb. of green matter due to the failure of the South-West monsoon. Yet the analysis of soil after the harvest of the subsequent grain crop shows a small but definite improvement in its organic matter status and base exchange capacity.

(f) There are about 30,000 acres of alkaline lands in the Cauvery-Mettur Project area which need to be reclaimed. A suitable area in a ryot's field has been selected near Pattukottai to serve as a model for adoption for the reclamation of the alkaline lands. Several ameliorants, such as gypsum, green leaves, lime, molasses etc., have been included so as to afford visual demonstration of the speed and cost at which each brings about the reclamation. The farmer himself could select the ameliorant most suited to him.

(g) The cry in the Nilgiris is that the cost of production of potatoes is too high, mainly due to the heavy dosages of manure that have to be applied. The Nanjanad formula calls for 1,600 lb. of mixed manure per acre over a basal of 5 tons of cattle manure or compost. While it is admitted by all that the dosage is heavy, the laterite soils coupled with steep slopes of the Nilgiris demand heavy dosages of manure to maintain the high productive level. An experiment has been initiated this year to explore this problem to find out if the dosage could be reduced, maintaining at the same time the high yields. This is sought to be achieved by altering the proportions of N. P. and K. and by resorting to indirect phosphate manuring to the leguminous green manure crop preceding the potato.

(h) Work done on the isolation of specific root nodule organisms for leguminous plant groups has enabled the supply of the right bacterial culture for practically all South Indian legumes. Requests for cultures are being received daily from ryots indicating their appreciation of the effect of inoculation.

(i) Studies have been in progress for the past few years in Wetlands, Central Farm, to obtain information for Coimbatore-soil-climatic zone regarding the most suitable green manure for paddy. The periodic visitation of drought in this district has been kept in mind while attacking the problem. Of the four green manures studied, Dhaincha, Sunnhemp, Pillipesara and Cowpea, Dhaincha was found to be uniformly superior to others particularly in droughty years.

In these various ways the Chemistry Section has been endeavouring to reach the farmer every time an investigation is designed.

On the occurrence of *Musa balbisiana* Colla., in S. India and its importance in banana breeding

By

K. S. VENKATARAMANI

Musa balbisiana Colla., has not hitherto been recorded as such in Indian literature on *Musa*. The species, however, has been found growing in certain tracts of this country for ages now and has been ranked as *Musa sapientum* (Roxburgh, 1824; Kurz., 1866), that mythical species, which is "the most confounded and confusing combination in the whole literature of *Musa*" (Cheesman, 1948a).

The classification of the bananas, more so that of the entire genus *Musa*, has been a much vexed problem; this has been discussed at some length elsewhere (Cheesman, 1934, 1947, 1948b; Venkataramani, 1946). The reasons for the existing chaos in the taxonomy of the bananas are very many indeed, but the confusion to group this seemingly distinct species as some other species may in part be due to the inaccessibility of the literature on *Musa* scattered in various journals not easily obtainable to the banana worker. Colla's original description of this species has been transcribed in a recent publication on the classification of the bananas (Cheesman, 1948a), in which is also given a generalized description of the species. It can be summarised as follows :

Plant suckering freely; pseudostems robust, green or pale green; leaf blades oblong, truncate at apex and rounded or slightly cordate at base; petioles long, their edges almost meeting over the

concave adaxial channel, margins developed in the lower regions and closely appressed to the pseudostem. Infloresoence is pendulous, peduncle glabrous, "heart" or male bud ovoid or ellipsoidal, bracts imbricate at the blunt apex; bracts rounded at apex, often with a green or yellow tip, more than one lifted at the same time, thus exposing a number of clusters of male (staminate) flowers simultaneously; bracts usually deciduous and occasionally persistent in a withered condition, especially in the later stages of blooming. Fruit bunch pendent and compact; individual fruits small, about 10 cm. in length and 4 cm. in diameter, angulate at maturity, abruptly narrowed at base into a short pedicel, and gradually at the stigmatic end into a short and broad beak; rind thick, pale yellow in colour when ripe; pulp whitish and with seeds; seeds black, irregularly globose, scarcely depressed, and about 5 mm. in dimension.

The above description agrees in most essentials with that of a wild seeded banana growing in certain parts of S. India and variously referred to as "Ela Vazhai" at Madras, "Ginjali arati" in the Circars and "Kallu Bale" in parts of S. Kanara district. This species has also been recorded from Ceylon and Mysore (Cheesman, 1948a). This again is quite distinct from the few other wild sorts growing in the S. Indian forests.

The importance of this species lies not so much in its mere occurrence in S. India as in the possible role that it might have played in the evolution of some of the edible bananas. A study of the numerous edible bananas will reveal the enormous diversity met with in the 'banana complex'. In a tentative classification of the South Indian bananas all the edible varieties are grouped under one species, *Musa paradisiaca* L. (Jacob, 1934). Our knowledge of the various species of *Musa* occurring in this country is rather inadequate in that many of the wild species have not yet been critically studied; a new species of *Musa*, *M. Agharkarii*, has been recently recorded from the Chittagong Hill Tracts (Chakravorti, 1948) and possibly there are some more which are not known to science. A detailed investigation of the taxonomy of the genus *Musa* as occurring in this country and also on the inter-specific hybridization, especially, with the species of the section *Eumusa*, may be expected to throw some light on the real status of our edible horticultural varieties — whether they are all varieties of one and the same species or they are derived from various sources. This is especially desirable before a classification of the cultivated

bananas is attempted, as work done elsewhere on banana breeding suggests that the origin of the edible bananas for the most part can be traced to three sources, one of which is of hybrid nature and the remaining two being associated with the natural species, *Musa acuminata* and *Musa balbisiana* (Cheesman, 1948b). Also, hybridization between these seeded species and the synthesis, from this inter-specific cross, of an edible banana closely resembling an established horticultural variety. Dodds and Simmonds, (1948) suggest that some of the edible bananas may after all be natural hybrids ingeniously propagated by man to meet his requirements. Some of the South Indian banana varieties show some of the characteristics of *Musa balbisiana* and the occasional seeds met with in some of them resemble to a great extent those of that species.

Musa balbisiana has been reported to have a wide geographical distribution; so also the other natural species, *Musa acuminata*. The writer is not aware of the occurrence of the latter species in S. India; it has, however, been recorded from Assam. The presence in this country of these two important species of the section *Eumusa*, which includes most of the bananas, can be taken as an indication of the diverse origin of our bananas, and it is hoped that these wild species will form useful parent stocks in any banana breeding programme contemplated in this country.

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Embryo-culture and its use in plant breeding

By

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Introduction: In view of the growing significance attached to embryo-culture in recent years in experiments with plants, an attempt is made in this paper to describe in some detail the evolution of the embryo-culture and its achievements in the field of plant breeding, besides giving some newly recorded observations made by the author in his embryo-culture work in maize.

Embryo-culture defined: Briefly told, *embryo-culture* means culturing of excised embryos in an artificial medium and attempts at imitating nature, in that the essential food materials and conditions of growth that the embryo otherwise gets from within the ovule are artificially supplied to it. The term *embryo-culture* ordinarily refers to the culturing of mature or slightly immature embryos. Culturing, however, of very young embryos is termed *pro-embryo culture*. In a normal diploid seed the growth of the embryo and the endosperm go apace. It is found, that so long as the chromosomal complements of the different parts of a seed, namely, the embryo, the endosperm and the seed coat bear to each other a definite ratio, for example, 2 : 3 : 2 in a fertilized maize ovule, there is harmonious development for these different parts from the time of fertilisation to the final stage of maturity resulting in a normal fertile seed. But whenever this proportion gets upset as it occurs in a wide cross even after triple fusion, there is disharmony in the growth pace of these different parts. If the endosperm acquires a comparatively lower complement of of chromosomes than the embryo, than the growth pace of this is slower resulting in an arrest of the normal growth and subsequent collapse of the embryo. The term *pro-embryo* in a wide cross refers to the growth period of the embryo before this collapsible stage is reached.

The basic idea of embryo-culture was first conceived in Germany about 50 years ago. Hannig in 1904 in Germany grew embryos from *Raphanus* and *Cochleria* to maturity after they had been removed from their ovules when they were about 1·2 m.m. long (LaRue, 1936). Stingle in Germany in 1907 (LaRue, l. c.) grew embryos of several grains in the different cereals in the endosperm of other species. White in 1902 grew embryos of

Portulaca oleracea that were much smaller than those bred by Hannig and disproved the assertion of Dietrich in 1924 that embryos less than $\frac{1}{3}$ the normal size could not be grown in the culture medium (LaRue, l. c.). He could not, however, secure continuous growth for the embryo which stopped growing after 3 weeks. The growth of sweet cherry embryos in an artificial medium was reported by Tukey in 1933 and 1934. Carl D. LaRue 1936, grew immature embryos of both dicots and monocots to seedling stage in the culture medium. He failed, however, to grow an embryo less than 5 m.m. long into seedling stage.

The growth and development of the culture medium as it is in use today

(a) *Agar as base for the medium:* Since the time of Hannig agar media of varying concentrations have been in use for embryo culture. It has been used from $\frac{1}{2}$ to 10 percent. Although 10% has been found favourable with some in America, it is found that the embryos fail to develop in this as uniformly as in low concentrations. Half and one per cent have given good results and 0·6% generally speaking, appears to be ideal. At this concentration, there is enough water available which is necessary to support a growing embryo, at the same time, possessing sufficient degree of viscosity for the medium to support the embryo on the surface.

(b) *Salt content of the medium:* Various salt solutions named after their advocates, have been in use. Pfeffer's, Knudson's modified solution, Upanski's, White's, Crone's modified solution, Knopp's complete nutrient solution, Tukey's and Randolph's are some that may be mentioned. All these have more less the same complement of mineral elements, but in different forms and proportions. Tukey is of the opinion that there is no appreciable difference in effect between the different salt solutions used by various workers. The concentrations could be varied from 1 to 10 times with no appreciable effect upon embryos or seedling development so long as the concentration did not exceed that which is toxic to the plant (Tukey, 1934). Tukey's basic medium has KCl, $CaSO_4$, $MgSO_4$, $Ca_3(PO_4)_2$, $Fe_3(PO_4)_2$ and KNO_3 for its ingredients and is now widely in use for embryo culture work. One of the advantages of Tukey's mixture is that the salts may be ground, thoroughly mixed and placed dry in a stoppered bottle and used over a period of months. The solution used by Randolph is essentially that of White, excepting that instead of KH_2PO_4, he used Sodium-hexa-metaphosphate $(NaPO_3)_6$. It is prepared in two stock solutions

and mixed together at the time of use. $(NaPO_3)_6$ forms a soluble complex with both iron and calcium and eliminates the difficulty inherent in most other mixtures in retaining in solution the small amount of iron necessary for optimum growth (Randolph, 1945).

(c) *Sugar in the medium:* Sucrose, Glucose and Fructose have been in use in varying quantities. Sugar has been found necessary for inducing chlorophyll development in the embryo in the very early stages, as otherwise, it does not grow. Therefore, the strength to be used depends upon the stage of development of the embryo to be cultured. Growth of more fully developed embryos is inhibited by sugar. Preferences for the particular form of sugar appear to vary with different plants. For a general purpose medium, to cover the range of requirements of both young and old embryos, 5% sugar as sucrose appears to be optimal.

(d) *Growth promoting substances:* The utility of growth promoting substances in embryo-culture was recognised as early as in 1922 by Knudson. Heteroauxin, indolacetic acid, glycocoll, propionic acid, adenine, thiamine, ascorbic acid, succinic acid, nicotinic acid, panto-thenic acid and Vitamin B_6 are some of them in common use. Natural extracts from Canna tubers, Carrot, Garden beet, Coconut meal, Datura ovules, Almond meal and Yeast have been found to help embryo growth. Van-Overbeek (1941) found in coconut water, an active growth promoting substance. He found that young Datura embryos were particularly responsive to coconut water. He tried the growth of a 10–day–old Datura embryo measuring less than 0·5 m.m. in Tukey's general purpose medium to which were added some of the physiologically active substances indicated above in certain proportions fixed on a purely arbitrary basis (Van-Overbeek, Conklin and Blakeslee, 1942). The embryo failed to grow. However, when coconut water was added to this, there was better growth of the embryo. In 1942, Van-Overbeek succeeded in extracting embryo factors from coconut water by fractionation process. He showed for this fractionation product, an embryo activity in a dilution of 1 : 4,000 parts, compared to 1 : 110 parts for untreated coconut water. With the help of this he was able to grow a 0·45 m.m. long embryo several times more than by using cocoanut water as such. But roots did not develop, evidently due to a root inhibitor. This was removed by further fractionation. The new preparation showed a factor activity at a dilution of 1 : 19,000. Using this he was able to grow an embryo 0·45 m.m. long into a perfectly normal seedling (Van-overbeek, 1942).

Van-Overbeek and his associates were able to culture very young embryos of Datura aged ten days and measuring only 0·15 m.m. long into normal seedlings with these fractionation products.

Uses of Embryo-culture: The uses of embryo-culture in plant breeding can be considered mainly under the following three heads,

(a) *Culturing of slightly immature embryos:* Culturing of embryos removed out of slightly immature seeds, helps to grow readily, seedlings from such seeds that otherwise do not germinate when mature, until after the dormant period (Goff, 1900).

(b) *Culturing of mature embryos:* Culturing of embryos excised out of mature seeds, helps quicker germination in seeds that have hard and impermeable seed coats.

(c) *Embryo-culture in the pro-embryo stage to get up F-1. generations out of incompatible crosses:* In a wide cross the embryo sometimes grows normally but the endosperm surrounding it ceases to grow or grows at a much slower rate so that the normal growth of the embryo gets arrested. Embryo-culturing just before this happens, in other words, in the *pro-embryo* stage, makes it possible to grow the embryo into a seedling. By this method Blakeslee working with *Datura stramonium* as one of the parents succeeded in securing species hybrids from combinations which had given only a single viable seed from many hundred pollinations (Blakeslee, 1944). In Blakeslee's own words, "we no longer have to wait for the chance hybridisation between species and the later rare spontaneous doubling of their chromosomes in order to secure such superior varieties. With the use of colchicine we can now make this to order, provided we have the sterile hybrids to start with. Thus embryo culture method should considerably increase the source of these sterile hybrids".

Some new lights on certain aspects of embryo culture as conducted and indicated below by the author in its use and application to breeding in maize.

(a) *Culturing of pro-embryos normal of diploid maize aged 3—7 days;* Previous workers on maize reported that 10-day-old maize embryos over 0·3 m.m. in length grew steadily in the culture medium (Haagen-Smit, 1945). They did not, however, indicate the reaction in a culture medium of a pro-embryo less than 10 days old. In the present experiment, culturing of pro-embrys aged 3—7 days

in Tukey's basic medium containing active growth promoting substances did not help to grow them into seedling stage. None of the embryos excepting the 7-day-old one showed any signs of growth in the medium (Uttaman, 1949). The 7-day-old embryo grew but ceased growth at the end of the 5th day. A similar case has been reported by White in 1932 (LaRue, l. c.). He was able to grow an embryo of *Portulaca oleracea* measuring only 0·12 m.m. to a size of 1·84 m.m. by adding a fibrin digest to his culture medium. The embryo, however, was unable to grow further at the end of the third week. It is clear that these active substances are not able to fully supplement the deficiency of natural hormones that this needs for its full development.

(b) *The effect of cocoanut water on the growth of immature embryos of maize :* In this experiment, it is found that cocoanut water has a decisive depressing effect on the growth of a 2-week-old maize embryo, although it does not totally inhibit its growth in the culture medium. Van-Overbeek in 1941, reported that in Datura embryo the roots did not develop in the presence of cocoanut water but the shoot did. This finding is not, then, in absolute agreement with the above results in maize (Uttaman, 1949 [2]).

(c) *A study in contrast of the effects of cocoanut water on the growth of immature embryos of maize when applied before and after germination of the embryo :* In this experiment it is indicated that the cocoanut water does help the growth of a maize empryo when applied after the embryo has started growing rather than when applied before germination, although Haagen-Smit (1949) reported no effect for cocoanut water on this. The reason for this differential behaviour in the embryo-growth in the present experiment may be found in the hypothetical suggestion that by the time the embryo starts to germinate the embryo factors decompose into certain toxic component parts which depress the germinating embryo and that most part of the opportunity to benefit by the embryo factors, is lost to it. That the loss of emryo factor activity of these natural extracts due to standing, heating, chemical actions etc., may be due to a release of toxic substances by their decomposition has been demonstrated by previous workers on Datura embryos (Van-Overbeek, Conklin and Blakeslee l. c.). It is further indicated that the embryo active property of any natural extract could be more readily and clearly understood by its application to the embryo after the latter has been initiated into sprouting than by application before germination (Uttaman, 1949 [3]).

(d) *Growth promoting factors in corn germ extract:* Lampe and Mills (1933) have reported the growth of 10-day-old embryos of maize in agar containing mineral salts, dextrose and extracts of young corn ovules. Aqueous extract of 2-week-old corn ovules was tried by the author without any spectacular effect on equally aged corn embryos. In this experiment, extract of sprouting embryos of mature corn seeds is tried on young corn embryos. The maize germ extract was prepared by finely macerating the germinal embryos of maize and then sterilising by Seitz-filtering under vacuum pressure as the extract may not be stable to auto-claving. The results of the experiment show that the maize germ extract has a marked beneficial effect, much more than of cocoanut water on the growth of a very young embryo of maize (Uttaman 1949.)

(e) *Embryo-culture to obtain F-1. plants out of incompatible crosses in maize:* Wide crosses usually do not set mature fertile seeds. Occasionally, one or more partially filled fertilised ovules are met with. These respond to embryo culture when young, although the mature seeds show indifferent germination. In the above experiment, 66 partially filled seeds were obtained from a cross between a tetraploid and a diploid maize plant. These seeds when pot sown gave only 15 P-1 plants of which one was a triploid. This was crossed to a tetraploid and the three partially filled seeds obtained from this cross were embryo-cultured when 16 days old. All the three, confirmed to be heteroploids by root tip studies, were reared into young seedlings. Embryo culture of very young seeds in this way helps to secure a greater percentage of F-1 plants out of incompatible crosses than by the ordinary method of germination of these seeds when ripe, by pot sowing (Uttaman, 1949 [5]).

(f) *A preliminary investigation into the viability of immature embryos of maize under conditions of cold storage at freezing point:* In any investigation requiring the dissecting out of several hundreds of embryos from immature kernels, any devise that preserve the young embryos inside the kernels from loss of viability should have a special significance, in that such an operation could then be conducted through several days without being obliged to do it all at one moment. From the present investigation, it is found that the viability of the young embryos of maize aged three weeks, could be preserved through a period of about 1½ months by keeping under cold storage at freezing point (Uttaman, 1949 [6]).

Culture technique: The embryo-culture technique mainly concerns itself with careful excising of the embryo from the seed and ensuring freedom from contamination by bacterial and fungoid infection of the embryo to be cultured.

The excising of the embryo out of a mature seed is best done after softening the seed coat by soaking for a day or two in water. If the size of the seed happens to be very small as in the case of a tomato seed, the operation can with advanage be effected by holding the seed between the edges of two mounting slides and then by dissecting with a fine razor blade. In the case of a very young immature seed, the excision is best done with the help of a fine needle and a scalpel under a preparation microscope. Employment of a fluoroscent light is advisable as the use of an ordinary incandescent light often seriously impairs the embryo, causing it to shrivel and die by the radiating heat. Freedom from contamination is gained by complete sterilisation of the culture medium and the containers on the one hand and on the other, by properly disinfecting the seed prior to the excision of the embryo, done under strict aseptic conditions. Sterilisation of the containers is best done by first cleaning the bottles and the caps with cleaning solution and then with boiling water. Screw caps are better than corks or plugs. After filling the bottles with the medium the caps are screwed half way down and the bottles auto-claved at 15 lb. pressure for 15 minutes. Upon removal from the auto-clave the bottle are cooled down by a slow process. This can best be secured by protecting the bottles from the wind current with a sheet of paper used as a screen. Otherwise there may be rapid cooling and the water vapour inside the bottle may condense down into water which might seriously affect the consistency of the medium. The medium may not set even after cooling. As regard the disinfection of the seed prior to the excision of the embryo, calcium hypochlorite method of Wilson has been in use for a long time 10 grms. of calcium hypochlorite is throughly shaken with 140 c.c. of distilled water and the clear liquid decanted. The seed is kept in this solution without bad effect for 3 minutes or more. Keeping for 5 minutes in a 2% chlorine solution has also been a standard practice.

The embryo-culture technique has now been greately simplified and standardised (Randolph, 1945). Any well lighted room reasonably free of the spores of moulds and bacteria is suitable for the transfer of embryos from the seeds to the culture bottles. The possibility of contamination from the air-borne spores may be reduced

considerably by spraying the table and the walls of the room with a 1% aqueous solution of phenol to which a few drops of a wetting agent such as Turgitol has been added.

For excising embryos out of mature seeds, the seed is sterilised in hypochlorite solution and then soaked in distilled water for 3 or 4 days according to the hardness of the seed with a daily change of water. Before excision the seed is dipped in 70% ethenol. Similarly all the instruments used in the operation and also the finger tips are dipped in this solution. The needle is then taken by a single passage through the flame of an alchohol lamp and then dipped in S. T. 37 (Hexyl-resorcinol) diluted 1 : 1 with distilled water. The embryo is like-wise dipped in this solution before taking to the medium.

The embryos are cultured first in darkness at 28 – 30°C. for 3 – 5 days and then transferred to weak day-light for another 3 or 5 days. There after the culture bottles are removed to the green-house from which direct sun light is avoided and in which the temperature is maintained at 65 – 85°F. After 2 or 3 weeks when the roots have developed, these are transferred to pots containing sterilised soil.

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A short resume of crop and plant protection, entomology-its past, present and future *

By

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Out of the seven lakhs of insect species estimated to exist in the world, about 10,000 are known to affect plant life. Of these about 500 species of insects are major pests affecting cultivated crops. As far as South India is concerned, nearly 600 insect species have been recorded as having a close relationship with cultivated plants and among these about 200 species are pests. It is with this number that the Crop and Plant Protection Officer (Entomology) has to tackle and devise remedial measures that would satisfy the agriculturist and horticulturist.

* Abstract of paper presented at the 32nd College Day and Conference.

The problem of the control of crop pests had been engaging the attention of a number of eminent workers, like Fletcher, Ramakrishna Ayyar and Ramachandra Rao, even from the early days of the Agricultural Research Institute at Coimbatore, but it was only in recent years - -when under the stress of war and famine conditions, the Government itself had to become a stockist of food grains, that the importance of entomology has been adequately recognised.

It is estimated that about 10% of every crop is lost on the average through insect attack in the field and another 5% when the produce is in storage. Thus an agriculturist has to lose nearly 15% of his hard-earned grain on account of insect damage. It is also an undeniable fact that when a serious pest like the red hairy caterpillar or paddy grass hopper devastates large areas, there is a corresponding increase in rural indebtedness in the succeeding years.

In our desperate search for making up the food deficit and stop all imports of food grains by 1951, it has been calculated that if all the pests and diseases of crops in India are effectively controlled, there would be no need for us to go to other countries with a begging bowl. It is however needless to add that for the workers themselves in the Crop and Plant Protection Service it is proving to be a very trying time-to rise up to the expectations and demands of the public. It is not always realised that problems can seldom be solved overnight or merely by posting the personnel. The officer and his assistants can by themseves do little, unless there is also available, all the other accessories, such as effective insecticides, efficient appliances and a trained staff. It is perhaps very fortunate that the need for large-scale crop protection has come at a time when a number of very potent insecticides are available in the market. We have now sufficient stocks of all the necessary insecticides like Gammexane, Zinc phosphide, Agrocide and Geusarols at the taluk depots, with reserve stocks at headquarters. It is gratifying to note that the plant protection service has acquitted itself very well already. The paddy growers of Gudivada taluk in Krishna district who were hitherto feeling they had hardly any thing to learn from the Agricultural Department, have openly expressed their opinion now that it is in our Crop Protection Service that they realise the usefulness of the Agricultural Department as it has rescued them from the depredations of grasshoppers and rats, against which they were hitherto helpless.

There is however, considerable scope for improving the Crop and Plant Protection Service. The following are a few suggestions that would help in making the service more effective and more useful to the general public.

1. The strength of the plant protection staff has to be increased in districts like Krishna where extensive work is to be done.

2. The staff must be properly equipped with speedy transport vehicles, proper camping requistes, spraying and dusting appliance.

3. Adequate stocks of chemicals and insecticides have to be built up and kept in strategic centres where from they could be obtained at short notice whenever they are needed anywhere in a particular district.

4. A large amount of publicity is also very desirable to keep the activities and the service rendered by the Plant Protection staff always in the public eye. This would help in a better and greater use being made of the Plant Protection Staff, by farmers, to their better advantage.

Potato tops and sprouts as seed

By

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Under the stress of wartime and postwar food shortages, new methods of growing potatoes without impairing yields are being explored in various parts of the world, at the Nanjanad Potato Station too, attempts have been made to reduce the seed rate of potatoes by making use of tuber tips and sprouts as planting material. The sprouts were removed from uniform seed tubers and planted in a nursery under shade with 2″ spacing. These sprouts were transferred from the nursery to the main field 3 weeks later. On the same day as these sprouts were planted in the nursery, seed tubers with sprouts intact and seed tubers with sprouts removed were planted in the main field. For tuber tips, uniform tubers weigning 2 ounces were taken and tips weighing half an ounce were cut from the crown ends. These were spread over moist gunnies for 48 hours for suberization after which fine sulphur was dusted

on the cut surfaces and the cut pieces kept on wooden racks for sprouting. These were compared with half ounce, one ounce and two ounce whole tubers (the variety used was Great Scot in all treatments).

The experiment was continued for nearly five years from 1944 to 1948 and the following are the conclusions from the data from these experiments:

The method of using sprouts for planting cannot be recommended in the Nilgiris, although Puskarnath * obtained "Good yields" from sprouts in Simla and even recommended this method for rapid multiplication of varieties. Under Nanjanad conditions constant attention and frequent irrigation were found essential. Under drought conditions sprouts are a failure. During the main crop and the irrigated crop seasons fair yields are obtained but they are uneconomical. Yields from tips were found to be always lower than those from whole tubers weighing two ounces. From a number of experiments extending over a period of five years, it is proved that 2 oz. tubers give the maximum economic yields.

It may therefore be concluded that neither sprouts nor tips are capable of being used in place of the usual method of using 2 oz. whole tubers in the Nilgiris. Fair yields can of course be secured, but for large scale planting by ryots, the methods are not suitable as the returns are uneconomical.

Some aspects of the fodder problem in the Madras Presidency †

By

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India is primarily an agricultural country, where cattle form the backbone of agriculture, both as prime movers for all farming operations and as suppliers of milk and manure. In recent years, the food problem in India has assumed serious proportions; but in fact the fodder problem is even more grave. Our deficit in fodder is over 100% and production must be more than doubled if our

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* Pushkarnath 1945. Current Science, 14 : 236-237.

† Abstract of paper presented at the 32nd College Day and Conference.

livestock is to be fed adequately Various views have been put forward to explain this fodder scarcity : one of which is that we are having too many useless animals that should be slaughtered forthwith. The real reason seems to be the lack of attentions that heifer calves get during the growing stages as compared with bull calves and the consequent slow growth and late bearing of such underfed animals. As a result of this chronic poor feeding, a needlessly large stock of cows have to be maintained to secure the necessary number of work bullocks. Under proper management with more liberal feeding, there would be no need to carry such a large stock of cow population.

The chief sources from which our fodder supply could be increased are (1) Forest grazing, (2) Grazing in Poramboke and waste lands, (3) private patta grazing lands and (4) fodders and crop residues from agricultural lands.

To improve grazing in forest areas, rotational grazing is necessary to give time for the grass to regenerate. Restricting the number of grazing cattle to the carrying capacity of the pastures and reseeding with nutritive fodder grasses and legumes are other means of which a rapid improvement can be effected. On porambokes and wasteland areas overgrazing is even more rampant and here it is essential that stringent control should be exercised in the matter of grazing, along with adopting such soil and water conservation measures as are necessary and reseeding over-grazed areas with suitable grasses and legumes. Private patta lands that are set apart exclusively for grazing are very limited in area; being found only in the important cattle breeding tracts of Ongole and Kandukur where the Ongole breed of cattle is reared and the Dharapuram-Palladam tract for the Kangayam breed of cattle. The grazing in these areas is generally good, though even here in recent years, much of the pasture area have been broken up for cultivation. There is plenty of scope for improving these pastures by introducing more nutritious grasses and legumes.

Fodder from cultivated lands: In our province, more than 93% of cattle depend on agricultural land for their fodder and only some 7% resort to forest grazing. Crop residues such as straws of cereal crops, haulms and bhusa of pulse crops etc., form the chief sources of fodder. The position at present is such that even if an increase of 50% is secured in straw yields by adopting intensive methods of cultivation, we are still faced with a huge deficit of 20

million tons of dry roughage per year. It is here that we have to examine the scope of mixed farming as a possible solution. In a mixed farming system, the farmer grows all the fodder that is needed for his livestock, on his own land. The manure obtained from his livestock is returned to the fields year after year and thus the fertility of the soil is maintained at a high level and crop yields increased. The results obtained in mixed farming experiments both in India and abroad, have shown that mixed farming is the only way to bring back the fertility of soils and secure high yields of grain and straw. A healthy relationship between animal, plant and soil is essential for success in farming and mixed farming is the only lasting solution for maintaining this relationship and solve our urgent food and fodder problems.

Some useful plants for green manure purposes, for the saline tracts of the Presidency

By

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"GROW MORE FOOD" is the slogan which we hear everywhere now, partly due to the after effects of World War II and partly due to the shortage of food crops on account of the ever-increasing population. India is passing through a critical period with regard to her food problem. India's production of food crops has not yet reached a level so as to be reckoned as self-sufficient. To keep pace with the rapidly increasing population, there should be a corresponding augmentation in production. The countries from which she was getting her food supplies, especially rice, from Burma, Siam etc., to meet her deficit, have also suffered during war and countries all over the world are not happy to ensure imports. There is besides, economic considerations, and we cannot be indefinitely importing. With the available cultivable lands, we are faced with problems of increasing food production by adopting all possible ways and means. Among the various methods suggested, the problem of manuring the fields has to be given a very prominent place in this work as it is a well known fact that our lands are impoverished.

Among the food crops of our Province, rice occupies a pre-eminent place as it forms the staple food for the majority of the population. The present area under rice is about 11 million acres and it forms the largest acreage of any one food crop of our Province. Rice is cultivated under a variety of conditions namely, dry, semi-dry and wet; there are again the alkaline or saline lands and those irrigated by fresh water. To suit the various conditions of rice culture one has to select a suitable manure. For the wet cultivation of rice, green leaf manure has been proved to be the best. The green leaf is either obtained by loppings of trees and shrubs or by raising green manure crops in the field and ploughing them "in situ". Trees and shrubs will be available in plenty only near forest areas but near the sea coasts or in the deltas, a crop has to be grown for green manure purposes. Most of the green manure plants come up well in good soils in fresh water; but regarding alkaline or saline soils the problem of growing suitable plants that will withstand the salinity has to be considered. For the delta areas many green manure plants are cultivated such as Sunnhemp, Daincha, Kolinji, Pillipesara etc., but there are vast paddy areas near the coast or adjoining the back-waters, as in the West Coast, where saline conditions do require some special plants which will withstand salinity.

To have some idea of the saline lands, a short introduction regarding their situation may not be out of place. The Back-waters or 'Salt lagoons' are quite common on the West Coast while in the East Coast they are more or less confined to the estuaries of big rivers like Godavari and Kishna. On the West Coast of our Presidency the broken nature of the country has brought about innumerable rivers and on account of heavy rainfall the volume of water carried by them is very great at times and the tidal influence is felt for many miles in the interior, especially during the summer when sea water freely flows into the river and this naturally renders the rice fields adjoining the back-waters saline.

In Malabar, 'the back-waters' and 'salt-marshes' are confined to the taluks of Chirakkal, Tellicherry, Calicut and Ponnani. In Chirakkal, the Baliapatnam river is one of the biggest and tidal influence is felt to a pretty long distance in the interior but the coconut gardens occupy the very edge of water for a fairly long distance, with scattered rice fields; similarly the Feroke river which is also saline, has coconut gardens almost up to the water edge. The salt-marshes near about Tellicherry, Badagara, Calicut and

the surroundings can be planted with any of the useful plants given below instead of the present vegetation which mainly consists of *Acanthus ilicifolius* L. This plant is spinescent all over and forms impenetrable bushes all over the marshy areas very rapidly, and if left unchecked, in several places it blocks irrigation channels and canals and is as big a menace as the Water Hyacinth in Bengal; this plant is unfit for any use. In Ponnani taluk salt marshes are abundant on either side of the Canolly canal and especially the area between the sea and canal towards the coast; towards the coast the canal is intercepted by several arms of back-waters which form the net work of canals near about Chawghat and Chetwayi. In this one comes across large areas of paddy fields, which are necessarily alkaline or saline on account of their proximity to back-waters. For these fields, the leguminous crops dealt with in this note will be of great use. In the South Canara district there are six principal rivers, namely Netravati, Gangolly, Sita nadi, Swarna nadi and Chandragiri, the back-waters or salt marshes formed by these rivers are met with in Kasargod, Mangalore, Udipi and Coondapur taluks. Of these the biggest back-water area is met with in Coondapur, where the Gangoolly river which is formed by the confluence of the waters of 'Kollur and Haladi rivers' joins the sea, resulting in an extensive back-water area. During the summer months, on account of the free onrush of tidal waves, salinity is felt several miles to the interior. Here we meet with typical forests of mangrove trees on either side of the rivers. These mangrove plants are specially adapted for saline or salt marsh areas and some of them grow to medium sized trees and are useful in preventing soil erosion of the banks. These trees produce abundant quantities of leaves and these can be readily used for manuring the rice fields adjoining these rivers. Mangrove plants particularly *Rhizophora mucronata* which grows to good dimensions in these tracts, may be used in planting the sides of the big rivers like Netravati, Baliapatnam, Feroke etc. When properly attended to, and pruned regularly, these plants are never a menace to the rivers; rows of these plants may conveniently occupy about 10 to 15 feet on each ride of the river. As already pointed out the salt marsh tracts of Tellichery, Badagara and other places which are now foul with *Acanthus ilicifolious* and other useless plants may be usefully planted with one of the mangrove trees listed below, for green manure purposes.

The following are some of the plants recommended for planting along the sides of back-waters.

1. ***Rhizophora Mucronata, Lamk*** (Rhizophoraceae). This plant is known in Tamil as Kandal, in Telugu, as *Upoo-pooma*. This is an ever-green tree often appearing buttressed by the mud being washed away from the branching aerial roots, the lower part of the stem dying off. The bark is a valuable tanning material, wood is dark red, very hard and an excellent fuel. *Propagation:* The fruits are viviparous and as soon as they fall from the trees on the miry soil, strike root.

2. *Kandelia Rheedii W & A.* (Rhizophoraceae) A small tree: bark reddish brown; used only for fire-wood; Telugu – Thuvar kandan.

3. *Bruguiera Conjugata,* Merr (Rhizophoraceae). A large ever-green tree; wood red, extremely hard, used for building and for fuel. Telugu-Thudda Ponna. Hindi : Kankara.

4. *Excoccaria Agallocha, Linn* (Euphorbiacea). An ever-green tree with a poisonous milky juice, bark grey, shining, wood white very soft. Telugu-Thilla; Tamil-Tilai – Malayalam : Komatti.

5. *Dolichandrone Spathacea* K. Schum (Bignoniaceae). A moderate sized deciduos tree common on the blanks of rivers and back-waters. Wood, white soft. Tamil-Vilpadri; Malayalam –Nirpongilium.

6. *Derris Uliginosa:* (Papilionacae). A large ever-green climing shrub with rose coloured flowers and rather large leaflets. It occurs in the sea coast forests and tidal river banks on both sides of the Peninsula; it is found climbing over trees growing along muddy salt water creeks. The leaves are poisonous and not relished by cattle; along with loppings of tress these may be also pruned. This flowers in August and September and the seeds are available from November onwards.

II. Plants recommended for the sand banks: A little away from the sea water front:

Morinda Citrifolia, Lin: (Rubicaeae) Tamil: Nuna; Malayalam-Manhanathi; Telugu-Sira Njikadai; occurs in the coastal forests of North Circars and West Coast: cultivated widely in many places throughout India. The roots furnish a valuable red dye. The fruits are cooked when unripe and eaten when ripe. This was found growing along sand banks adjoining the back-waters of Udipi. It is a medium sized tree producing broad leaves in plenty

Scaevola frutescens, Krause (Goodeniaceae) Marathi: (Bhadrak). It occurs in the West Coast near the sea; found near the water-edge of the back water, very close to the sea near Malpi. A large shrub with large fleshy leaves, white flowers in axillary cymes and a white somewhat lobed droupe. Found also near the sea shores of India from Sind to Ceylon. It is stated that the juice of the berries were used for clearing off opacities in the eyes and to take away dimness of vision. Leaves are eaten as a vegetable (Watt).

Pavetta indica L. (Rubiaceae) (Hindi : Kankro). A small sized tree with white flowers found growing along the sand banks at the junction of the sea and back water near Nileshwar and Kasargod; the root and leaves are used as medicine by Ayurvedic doctors (Watt). The fruit is eaten in some parts of Madras (Watt).

III. Leguminous plants recommended for saline rice fields.

Crotalaria striata: (Papilionaceae) (Tel.-Munga). A tall herb growing upto a height of 2 or 3 feet occurs in low lying areas and sandy tracts; it was also found to occur under extreme saline conditions namely on the sea sand near the junction of back water and sea, near Nileshwar. This is cultivated on a large scale in Nileshwar coconut farm, and seeds may be available there.

Crotalaria Verrucosa: (Papilionaceae) (Tamil: Vuttei Khilloo) (Tel.-Ghele gherumta). It occurs under a variety of conditions, namely Nilgiris, Cuddapah and sandy belts near the sea coasts. This is recorded along both the sea coasts. This is found growing very near the reach of tidal waves also. Grows to a height of 2 to 3 feet; much branched undershrubs with blue flowers. Propagation by seed.

Rothia trifoliata Pis. (Papilionaceae) T: Nurrey pittan keeray; Tel: (Nucka Kura). A much branched and spreading annual, spreads to a radius of 1 to 1½ feet. Leaves and pods are boiled and eaten as a vegetable in times of famine. (Flowers in September and October).

Research Notes

Viability of ragi seeds (Eleusine coracana): In Vissakhapatnam district, in wetlands it is customary to grow a crop of ragi (early) in May—August season preceding the main paddy crop and another crop (late) in December—April, succeeding the paddy crop. At the Sugarcane Research Station, Anakapalli in 1945—1946 certain fields were cropped with early ragi. These fields were planted to paddy and after its harvest the land was prepared to take in the late ragi. Soon after these operations the fields were found to be covered with ragi seedlings. These could not have been due to seeds carried in the manure since other fields manured from the same heap were entirely free from ragi seedlings. The only source then was from the early ragi preceding the paddy. It was however, doubtful whether the ragi seeds shed in field could live through the puddled submerged condition prevailing during the period of the paddy crop.

To verify these observations pot experiments were conducted simulating the conditions in field. Six small pots with soil from wetlands were sown each with 200 seeds collected from the late ragi and soil throughly raked up. The pots were watered and the level of water maintained at 2″ over the soil, for a period of four and half months to correspond to the duration of the paddy crop. The soils from the small pots were transfered to bigger pots with similar soil, throughly raked and allowed to dry up completely in the sun. After four days of drying the pots were watered to give optimum conditions for germination and the germination counts taken. This experiment was repeated between 2—9—1946 to 20—12—1946. The results are summarised below. In all cases 200 seeds were sown:

Pots Nos	Periods of investigation			
	10—4—1946 to 31—8—1946		2—9—1946 to 20—12—1946	
	No. seeds germinated	Per centage of gemination	No. seeds germinated	Per centage of germination
1	43	22	76	38
2	72	36	108	54
3	38	19	68	34
4	48	24	121	61
5	31	16	103	54
6	36	18	49	25
Average	44·6	22·5	87·5	44·3

A third experiment avoiding all possibilities of seed contamination from field and manure was conducted by placing the freshly harvested seed immersed in water in a glass bottle. Daily changes of water were given. The experiment was started on 2—9—1946. The seeds were removed from the bottle on 26—12—1946 and sun-dried till they became hard. The per centage of germination were found to be: set I = 79; set II = 84. It was thus proved that ragi seeds retain their viability under paddy land conditions at least for four months. It is therefore not safe to grow, especially, ragi crop meant for seed purposes in a field previously cropped with early ragi.

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Gleanings

Observations on human behaviour in experimental semi-starvation and rehabilitation. Franklin, J.C., Schiele, B.C., Brozek, J., and Keys, A. In contrast to the disapperance of hunger said to occur in total starvation, the semi-starved subjects were always hungry, though some suffered more than others. Desire for dietary variety was very strong at times, but was always subordinated to a craving for bulk. Food became the dominating factor in thought and action. Eating habits showed a possessive attitude, subjects hovering closly over their trays and eating silently and deliberately, with intense concentration. Every particle of food was consumed, and dishes were licked. Many men showed fantastic ingenuity in making food last, and in developing new ways of modifying dishes as served. Fluid intake rose so markedly that a limit of 9 cups of coffee daily was imposed; even so, many subjects brewed the strongest possible cups and increased the volume by dilution, or consumed the liquid portion of soup and then repeatedly added water to the solid residue. There was little tolerance or humour towards matters concerning food. Waste became a major crime, and lack of "seriousness" on the part of cooks and servers caused much irritation.

Emotional instability resulted from the stress, apathy being very marked except in relation to food and the experimental life, about which all interest tended to narrow. Irritability increased untill it became an individual and group problem. Nervous tension was revealed also by increase of such habits as nail-biting, gum-chewing and smoking. Personal appearance was neglected though bathing remained popular since it provided warmth. Humour "dried up", and the tone of the group became sober and serious, apart from the exhibition of irony and sarcasm. Curious forms of acquisitive behaviour presumably compensated for food deprivation. Useless articles were bought and stored up, and the collection of food recipes became a fad. Intelligence, as tested, appeared to remain at its normal level; men often believed they had suffered intellectual deterioration, but this was due to narrowing of interests, apathy, and lack of initiative in conversation and study. During rehabilitation, energy and physical well-being increased roughly in proportion to caloric intake. Recovery from dizziness, apathy and lethargy was rapid, but tiredness, loss of sex drive, and weakness were slow to improve. Appetites remained insatiable for a long time, and habits such as plate licking and "toying" with food persisted. Many men became more depressed and irritable through a sense of disappointment at the failure of the expected "new lease of life" to materialise quickly. But discontent and aggressiveness replaced apathy and aquiescence, and gradually physical, social and cultural interests reappeared.

After 12 weeks of rehabilitation, 12 men remained under observation, but were allowed to eat as much as they liked at weekends. During these 2-day periods they ate more or less continuously, consuming 6,000 to 7,000 cal. daily. Manipulation of menus, licking of plates and intolerance of waste (despite obvious abundance) were still very noticeable. In general, the men ate more than they should have, and there were many instances of sleepiness and gastro-intestinal upset. (J. Clin Psychol 1948, 4, 28—45. (Lab. physiol, Hyg. Univ. Minnesota). T. R. N.

Coir dust or cocopeat-A by-product of the coconut—*E.P. Hume:* During the separation of coconut fiber by machinery some very short fibres unsuited for cordage but well suited for manufacture of the door mats are produced. A by-product of the latter industry is a mass of tiny, brown, irregularly shaped, particles known as 'Coirdust'. Since the term 'dust' is misleading and the possibility of using this by-product in horticulture, the author has suggested instead the name 'coco-peat'. The meagre literatures chiefly from India and Ceylon dealing on this substance, recommend its use as a material for increasing organic matter in horticulture, as manure direct

or as material to absorb the cattle urine and a bedding for stock. Its slow decomposition has also been noted. Only one author has dealt with its chemical aspect as fertiliser. He has shown that it has less than 1% of any major nutrient and is unfit as fertiliser and that its slow decomposition is due to its low pentosan lignin ratio (40% lignin : 12% pentosan). Its decomposition is hastened if materials like grass are increased. By adding even small quantities to sandy soils their moisture content is increased from 24 to 33·2%. By itself the dust can retain over 80% water on dry weight basis. A recent chemical analysis of this dust done in the U. S. A., is as follows :—

Mineral composition of 3 fresh samples of unscreened cocopeat.

Sample.	Ash. %	Ca. %	Mg. %	K. %	P. %	N. %
1.	2·39	0·42	0·63	0·82	0·07	0·11
2.	2·45	0·39	0·70	0·25	0·09	0·11
3.	2·48	0·31	0·65	0·84	0·02	0·11

A four year old, well-weathered sample also showed extremely little decomposition. It is fairly rich in iron and manganese (17 P. P. M. water-soluble manganese, 33 P. P. M. of exchangeable and 63 P. P. M. of reducible manganese ; iron, 100 P. P. M. water-soluble, 78 P. P. M. exchangeable and 81 P. P. M. reducible iron.): slightly acid with a P.H. value of 5·7 to 6·7. Cocopeat is slow in decomposition, hence requires less frequent replenishing than other mulching materials and is generrally mixed with soil by action of earthworms etc., eventually improving the soil. It has been found that cocopeat is not toxic but on the other hand stimulative to growth. The only difficulty with cocopeat as a mulching material is its light weight when dry. This could be easily overcome by preventing surface waterflow and also by a light dressing of sand on the top. This has a great advantage in being free of weed seeds. Cocopeat while consorving moisture in the soil also allows rapid penetration of even a small shower of rain. Mixed with heavy soil it improves its physical condition making it porous, and facilitating drainage and aeration. Mixed with sandy soil even in small percentage, the moisture content is improved. In top mulching of clay subsoil the cocopeat absorbs and holds most of the water and allows its penetration slowly. Cocopeat is also useful in propagating seeds and cuttings. It is best used mixed with equal parts of sand and compost. It's further use in horticulture has to be investigated. (Economic Botany 1942, Vol. 3, P. 42—48). N. K.

How Britain Plans to Raise Farm Production

20 per cent. increase by 1952

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The recent appeal to the nation by the Prime Minister of India, Pandit Nehru, for a concerted drive to tackle the food problem by producing 15 per cent more and becoming self-sufficient in food by 1951 finds a parallel in Britain. Farmers there have been asked by the Government to raise agricultural output by 20 per cent, by 1951-52. In the article below the author points out how they are planning to reach the target.

Although formers in Britain produce only for the home market they cannot, on the limited land available, grow enough food to feed a population of 50,000,000. In the year 1948-49, 49 per cent of her total food supplies, measured in protein, was imported and in terms of calories, 63 per cent.

When imports were severely cut during World War II because of shipping difficulties, the farmers of Britain made great efforts to fill the gap. Today even more food is called for, because the country can only afford imports to an amount which can be paid for by exports. The farmers, by growing more per acre, can help to save foreign currency so that enough is left to buy the raw materials which are indispensable to the industries which make goods for export and the home market.

The Government has asked farmers for a net output per acre in 1951 52, 20 per cent, higher than that of 1946-47. Wheat, eggs and pig meat are especially emphasized in this expansion programme, details of which are known throughout the farming community.

Advisory Services. Some part of the increased production will be achieved by better use of existing resources as technical knowledge spreads and less efficient farms are brought up towards the level of the best. The Government has set up advisory services to assist farmers and estate managers to make use of recent discoveries and new methods.

It is fully recognised, however, that if farmers lack the necessary resources they cannot raise the output. Land itself is much in demand for other uses besides agriculture, and although some reclamation and improvement of waste land will be possible, no extension of the total farm area can be hoped for. The present labour force is expected to be adequate, though it will still be necessary to find extra help at the busiest times.

The chief need is for equipment and supplies which will make labour more productive. More machinery, fertilizers and other supplies will have to be brought on to the farms, new farm buildings must be built, and old ones renovated and improved. Agriculture has to compete whith many other industries for steel, timber and other materials used in construction and manufacture. The Government attempts to allocate supplies in proportion to the urgency of the various needs Over the four years ending in 1952-53, £450,000,000 (Rs. 600, crores) will be spent on capital equipment for agriculture. Most of the money must come from farmers or landowners themselves.

Tenant Farmers. Over 60 per cent. of farm land in the United Kingdom is not owned by the farmers who occupy it. They pay an annual rent to the landowner. In return the owner has to provide all the fixed equipment (such as farm buildings roads, fences, drains, and water supplies) which are necessary for efficient farming He must keep this equipment in good repair and carry out such alterations and improvements as are needed. These obligations are laid down in the Agriculture Act of 1947, and failure to observe them may result in supervision, direction and even dispossession of the landowner. The long-term programme provides £ 24,000,000 (Rs. 32 crores) to be invested by private landowners in 1949, and this should rise to £ 30,000,000 (Rs. 40 crores) in 1951. New farm buildings—cow sheds, machine sheds, Dutch barns, and so on — will take up most of this expenditure, but many owners are also planning to build or repair farm-houses and cottages, and to improve drainage and the supply of water and electricity. New works actually undertaken in 1948 showed that owners were measuring up well to their part. Arrears of maintenance work are being wiped out. Rents are adjusted to include payment of interest on these improvements, for most landowners cannot finance the investment out of income. The £. 24.000,000 represents over half the total annual rent and is, of course, additional to normal expenses of management. Owners, therefore, have to borrow or draw on their capital. Bank advances for agricultural development have substantially increased in recent years.

Increased Mechanisation. Farmers, on their part, have to provide the working capital which the programme demands. Over the next four years they will require new machinery and replacements costing about £. 50,000,000 (Rs. 66·67 crores) a year. Many tractors have been bought since 1939, though even at that time there were 60,000 in the U.K., or one to every 220 acres of arable land. Nearly all farms having 30 acres or more of arable land are now equipped with a tractor; most farms of over 200 acres have two; and it is quite usual to find three or four tractors, as well as five or six horses, on arable farms of 300 acres or more.

There is now almost enough power-driven machinery to carry out the increased cropping plans, and the present total of 260,000 tractors will not be incroasd beyond 300,000 during the four-years period. Purchases will mainly be replacements.

More than half the agricultural tractors in use in countries receiving Marshall Aid are in the United Kingdom. The other contries are pressing on with mechanisation. Norway, Sweden, Denmark, Switzerland, Ireland and Turkey all plan to have at least 20 per cent. more machanisation in agriculture in 1950-51 than they had before the war. Mechanisation in the U. K. will make a major contribution to the increase in output per worker. The range of impenements on the farm is continually widening. To handle the extra acreage of grain, 11,000 combine harvesters should be available in 1950, compared with 6,500 in 1948. New types of machines to deal with labour-costly root crops (especially potatoes and sugar beet) are expected to be brought in ever increasing numbers; while the compaign for extending the practice of grass drying should result in the use of at least 1,500 driers in 1950.

Price Fixation. Grass is still potentially Britain's richest crop, but farmers must buy at least 20 per cent more fertilizers and use a large part of this on pasture land. This will provide more feed for cattle, but increased quantities of imported feedingstuffs will have to be bought to establish and maintain much larger populations of pigs and poultry which are to be kept.

The cost of all these machines and supplies has been kept in mind by the Government when fixing the future prices which formers will receive for their produce. These prices have been designed to allow a margin above the normal cost of production and sufficiently wide to enable farmers to meet the additional investment. Figures given by the Economic Commission for Europe show that in 1948 four per cent. of the gross investment in fixed capital in the United Kingdom took place in agriculture. In most contries of Europe, remarks the Commission, "the share of agriculture in total investment was not at all commensurate with the importance of agriculture in the national economy". Net investment in agriculture (excluding repairs and maintenance) was actually negative in some countries (such as Czechoslovakia and Bulgaria), but the figures may conceal an increase in numbers of livestock being carried. France and the United Kingdom, however, are singled out as showing "adequate appreciation in their plans of the importance of agricultural investment." (British Information Services.)

ERRATA.

Vol. XXXVI No. 11.

1. Page 509 — Statement of Acidity lists — under "Butter" — item 5 (against 8 days storage) — last column (under Butter milk) — *for 0·0937 substitute 0·1471*. (The same figure 0·0937 is repeated twice. The first is correct, but the 2nd is wrong, which has to be corrected).

2. Page 510 — Line 31 — *for 9·0536 substitute 0·0536.*

3. Page 510 — Lines 38 and 39 — *delete "flaccid at the end"* (This not mentioned in the original).

Agricultural News Letter

Sea Island Cotton in West Coast: Cotton stands transplanting and cut stems root freely. This is revealed by trials at Mangalore, Nileshwar and Pattambi. The cuttings and seedlings establish better when transplanted on rainy days. No difference between the seed-planted and transplanted plants was seen in growth.

Vellai Cholam: Two new strains of Vellai Cholam, evolved at the Millet Breeding Station, Coimbatore, bearing the station number Co. 12 and Co. 13, have recently been released to the cultivators. Strain Co. 12 is a selection from a variety of Uppam or Mottaivellai cholam of Palladam taluk of Coimbatore district. This high yielding strain is of special importance at the present period of food crisis and it also satisfies the long-felt need for a strain of very short duration among the irrigated Vellai cholams. It matures in 85 to 90 days and can be grown in January to April and March to June seasons. This strain has a compact panicle, red glumes and bold chalky white grain. Its short duration is a great asset and it is bound to be popular in areas of limited water resources and also in places where intensive cultivation is practised. This strain has already undergone a series of trials, both at the Millet Breeding Station and in the districts. Its performance has been uniformly good in all the centres of trial. Co. 12 was earlier than the local types by two weeks in Tinnevelly district and yielded 19 to 100% more grain than the local. Reports of high yields, ranging from 15 to 56% more grain than the local were received from Coimbatore, Tiruchirapalli and Chittoor districts also.

The strain Co.13 originated from another irrigated variety called Ennaivellai Cholam of Gobichettipalayam. It is similar to cholam strain Co. 8 in respect of yield and duration; but differs from it in having bolder grains. This strain meets the demand for a high-yielding strain of Vellai cholam, having a bold grain and a duration of 105 days. It has been tried at the Millet Breeding Station for several years, and high yields exceeding 3,000 lb. per acre have been recorded. In district trials, it was found to be superior to the local types of Gobichettipalayam, giving 15% increased yield of grain. It is proposed to extend the trials of these new strains to other centres of irrigated cholam. Arrangements are being made to multiply the strain at Coimbatore, with a view to supply nucleus seed to bonafide cultivators, who agree to try this in systematic trials, and grow them under seed farm conditions. Cultivators, who wish to try these new strains, are requested to write to the Millet Specialist, Lawley Road P. O. or the Local Agricultural Officers for their requirements.

Control of Millets Grasshopper Pest: The millets grasshopper was found occurring as a pest in Rajampeta and Vontimetta areas of Cuddapah district for the last three years. This grasshopper pest not only badly defoliates the cumbu, cholam and tenai sown in the month of June but even attacks the earheads and makes them empty. In the occurrence of this pest in the course of 1948, the fields were left bare in some of the areas and there was nothing left for the ryots to reap. The fodder for cattle was also lost.

Control measures: It is necessary that these grasshoppers should be destroyed while still young with green colour and before they become adults with wings. In so destroying the pest, we not only save the crop of the present year but even prevent the pest from laying eggs and carrying itself to the next generation in the following year. For the destruction of the pest in the field, Gammexane D ·025 dusting at the rate of 20 to 25 lb. per acre had given spectacular and effective results in the campaign in Cuddapah district. In a short time after dusting, we find the

young hoppers falling down to the ground in numbers. The insecticide is kept in stock in all the Agricultural Departmental depots for sale to ryots. For use with food crops, pulses, vegetables, and root crops, the Government charges the ryot only half the cost plus incidental charges as a concession to encourage the savings of these crops from insect pests and disease. At this concession rate for dusting cumbu, cholam and tenai crops, it costs about Rs. 4/- per acre and since the average yield per acre of these irrigated crops in the area is 1,500 lbs. per acre, a ryot is sure to save at least half of this, costing Rs. 100/-. There is advantage in killing the pest in its early stage of 'young hoppers'. The planted fields, nurseries, left overs in nurseries and grassy patches round the fields will have to be dusted with Gammexane. Dusting can be done by splashing the insecticide with hand and the Agricultural Department has also some dusters for supply to ryots. During the year 1949, a total area of nearly 1,700 acres in Rajampeta and Vontimetta areas was dusted with Gammexane, ridding these areas of this pest. There was considerable response from the villagers in the areas in adopting the control measure and the relief afforded by the treatment was fully availed of. It is hoped that the ryots in other places, where they have thir pest, would report its occurrence to the Agricultural Department and save their crops from this bad pest of cereals.

Fungicide treatment of seeds: In recent years, seed-treatment before sowing has been accepted as a regular farm practice, in order to eliminate losses due to seed-borne diseases or soil-borne diseases, which affect the plants in the seedling stage. With the urgent need for greater food production, greater attention must be devoted to seed-treatment, in order to increase the stand and thereby increase the yield. Many seed-borne diseases are prevalent in our food crops, which will respond to seed-treatment. The foot-rot of rice and helminthosporios of rice are controlled by treating the grain with organomercury compounds like Agrosan GN or Ceresan. Grain smut of sorghum is easily checked by treating the seed with sulphur powder. Seed dresssing with Ceresan or spergon is very useful in preventing damping off and other diseases affecting tomatoes, peas and beans. Sweet potatoes are treated for protection against tuber-borne rots and some soil-borne fungi. Seed ginger is dipped in a dilute solution of mercuric chloride to prevent storage rot. These treatments are comparatively cheap. But some of the chemicals used are poisonous and the materials treated should be used only for sowing and not for food.

Ratooning of Sugarcane: Ratooning of sugarcane is becoming a common practice and many ryots ratoon their crop repeatedly three or four times or even more. Their main object in ratooning is to save the cost of preparatory cultivation and the cost of seed. But they generally neglect all the items of cultivation and are satisfied with whatever yield that could be got. This is not correct. Ratoons require more attention than plant crops because (a) the field had no preparatory cultivation and hence initial fertility is low; (b) cane after cane follows and hence there is no rest for the land. (c) there is possibility of carry-over of pests and diseases of previous crop; (d) ratoons are generally of poor vigour in growth in later stages. It is, therefore, essential to take particular care of the ratoons, in order to get higher yields and also to prevent rapid soil deterioration. The following are recommended for ratoons: (a) harvest the plant crop flush to the ground or even one to two inches below the ground; (b) disturb the ridges and furrows by working a light plough. (c) give a heavier dose of manure than to plant crop; (d) remore unthrifty plants by August - September; (e) pull out smutted clumps and burn them. (f) ratoons mature earlier and they may be harvested one or two months earlier than the corresponding plant crops. Ratoons of the different varieties are to be harvested first before plant crops in factory zones, to increase recovery percent.

Sugarcane for water-logged conditions: Sugarcane is generally grown in wet lands once in three years, in rotation with the paddy. Naturally, when sugarcane is preceded and succeeded by paddy, it is sourrounded by paddy crop on all sides, and consequently swampy conditions prevail for sugarcane also. But sugarcane comes up excellently in well-drained soils only and is not quite tolerant to bad drainage. Besides, in the areas adjoining tank-bunds and places, where the water table is high, drainage is inadequate, resulting in water-logged conditions in the fields. Most of the sugarcane varieties fail to thrive satisfactorily under the swamp conditions and it was found after a through experimentation at the Sugarcane Research Station, Anakapalle, that Co. 419 is the best variety for such conditions. It is better to plant the cane early i.e., by about the middle of February, so that the crop can make good growth before the advent of the monsoon. When the crop has grown up to some extent, it is able to resist the water-logged conditions better. Canes grown under water-logged conditions mature earlier i.e., by December-January and the recovery of jaggery per cent is more and the quality better. In a series of trials with different varieties conducted at this station, it is noted that Co. 419 is unrivalled in yield under swampy conditions, with an average yield of 38 tons of millable cane per acre, when planted early in February. This yield is less than that from a crop under normal conditions by about 5—8 tons, and this difference is compensated to a certain extent by higher recovery of better quality of jaggery and early harvest and marketing when prices are usually high. Hence Co. 419 is recommended for all soils liable for water-logging during the monsoon and it has to be planted about a month earlier than the normal.

Hybrid Cumbu Strains: Two hybrid strains of cumbu X. 1 and X. 2 evolved at the Millet Breeding Station, Coimbatore, have been found to be outstanding in their yield performance in the Coimbatore district. In trials, conducted at Ondipudur, both the hybrids were superior to the local cumbu. These strains X. 1 and X. 2 gave 1,296 lbs. and 1,200 lbs. of grain per acre respectively against an acre yield of 830 lbs. of the local type. The increases in yield were 56% over local in the case of X. 1 and 44·6% of X. 2. These hybrid strains have also done well in the Tiruchirapalli district and they are now being tried in the other districts of the Presidency.

Livestock improvement: Eighteen Murrah buffalo bulls and 17 Scindhi bulls were purchased from North India and distributed under the Livestock (bull) Distribution Scheme to the various districts in the Province, for the improvement of Livestock. Government have also sanctioned the opening of a District Livestock Farm in the Malabar district

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Crop and Trade Reports

Statistics-Crop-Intermediate Condition-Report Madras Province 1949—50.

Gingelly. The gingelly crop has been affected by severe drought in Anantapur district and by insect pest in the district of Bellary during the period of its growth. The yield per acre is expected to be below normal in the districts of Guntur, Bellary, Anantapur, Chingleput and Malabar and normal in the other districts of the Province. The wholesale price of gingelly seed per imperial maund of 82 2/7 lb. as reported from important market centres on 5—11—1949 was Rs. 32—15—0 in Tirunelveli, Rs. 30—12—0 in Eluru, Rs. 30—10—0 in Visakhapatnam, Rs. 30—4—0 in Tiruchirapalli, Rs. 30—2—0 in Kakinada. Rs. 29—12—0 in Rajahmundry, Rs. 29-10-0 in Tuticorin, Rs. 29—5—0 in Cuddalore, Rs. 28—14—0 Vizianagaram and Rs. 28—12—0

in Salem. When compared with the prices published in last report i.e., those which prevailed on 8—10—1949, these prices shown an increase of 9 per cent in Kakinada and 2 percent in Tuticorin, the prices remaining stationary in Tirunelveli, Eluru, Tiruchirapalli, Cuddalore, Vizianagaram and Salem.

Groundnut: The winter crop of groundnut has been affected by recent cyclonic rains in the districts of Krishna and Guntur, by want of timely rains in the districts of North Arcot and Coimbatore and by attack of insect pests in the districts of Bellary, Anantapur, Chingleput and Ramnad. The condition of the crop is generally satisfactory in the other districts of the Province. The wholesale price of groundnut (machine shelled) per imperial maund of 82 2/7 lbs. as reported from important market centres on 5—11—1949 was Rs. 30—4—0 in Cuddapah, Rs. 29—5—0 in Bellary, Rs. 28—11—0 in Tadpatri, Rs. 27—14—0 in Hindupur, Rs. 27—2—0 in Coimbatore, Rs. 26.—8—0 in Guntur, Rs. 26—6—0 in Guntakal Rs. 26—4—0 in Nandyal, 25-15-0 in Erode, Rs. 25—9—0 in Adoni, Rs. 25—2—0 in Vizianagaram, Rs. 24—13—0 in Salem, Rs. 24—3—0 in Cuddalore, and Rs. 23—4—0 in Vellore. When compared with the prices published in the last report i.e., those which prevailed on 8—10—1949. these prices reveal an increase of 21 percent in Coimbatore and a decrease of 17 percent in Guntur, 15 percent in Adoni, 13 percent in Cuddalore, 12 percent in Nandyal and 10 percent in Erode. The prices remained stationary in Cuddapah, Tadpatri and Hindupur.

Sugarcane: The condition of the sugarcane crop is generally satisfactory in all the districts of the Province except in Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur and Bellary. The crop has been affected by heavy rains in parts of Visakhapatnam, by cyclone in East Godavari, West Godavari, Krishna and Guntur and by lack of adequate supply of artificial manures in Bellary. The yield is expected to be below normal in the affected districts and nearly normal in the other districts of the Province. The wholesale price of jaggerry per imperial maund of 82 2/7 lbs. (equivalent to 3,200 totals) in the important market centres in the Province on 3rd December, 1949 was Rs. 31—13—0 in Adoni, Rs. 30—7—0 in Cuddalore, Rs. 29-6-0 in Mangalore, Rs. 28—0—0 in Salem, Rs. 26—12—0 in Bellary, Rs. 26—7—0 in Tiruchirapalli, Rs. 26—0—0 in Erode, Rs. 25—10—0 in Visakhapatnam, Rs. 21-6-0 in Kakinada and Rajahmundry, Rs. 20—9—0 in Vellore, Rs. 18—5—0 in Vizianagaram and Rs. 17—8—0 in Chittoor. When compared with the prices pubished in the last report i.e., those which prevailed on 5th November 1949, these prices reveal a rise of approximately 16 per cent in Cuddalore, 13 per cent in Vizianagaram, 9 per cent in Adoni and 3 per cent in Bellary and a fall of approximately 25 per cent in Erode, 24 per cent in Chittoor, 23 per cent in Rajahmundry, 16 per cent in Vellore. 13 percent in Visakhapatnam and 8 per cent in Kakinada, the prices remaining stationary in Salem, Tiruchirapalli and Mangalore.

Paddy: The harvest of the first crop of paddy is progressing in parts of the West Godavari and Chingleput districts and has either concluded or is concluding in the Central districts the South and the West Coast. The yield per acre is expected to be normal or nearly normal in the West Coast and the Nilgiris district, and below the normal in the districts of West Godavari, Chingleput, Coimbatore, Tiruchirapalli, Tanjore, Ramnad and Tirunelveli. The reduction in yields is expected to be large in the West Godavari district, on account of the damage caused by the recent cyclone, and in the Chingleput district due to delayed and insufficient rains.

Condition of standing crop: The standing crop of paddy is reported to have suffered extensive damage in the Circars districts, as a result of the floods and the cyclone which swept these districts recently. The damage to crops is expected to be severe in the districts of East Godavari, West Godavari and Krishna, Where

almost all the standing crops have been affected and consequently the yields are expected to be vary much reduced in those districts. In the Vishakhapatnam district the condition of the standing crop is reported to be not fair, due to damage caused by floods. In the Guntur district the loss to crops is not expected to be so severe. The paddy crop in the low-lying areas of Ongole, Tenali, Bapatla and Repalli taluks were submerged and were damaged to some extent, but the condition of the crop in the other taluks is reported to be fair. In the Deccan, the standing crop is reported to be generally satisfactory in Kurnool and Bellary districts. The crop in the Anantapur and Cuddapah districts has been affected to some extent by want of timely rains, but the prospects are generally fair. The condition of the crop in the Nellore district is fair and prospects are good, more rains are needed in some of the upland taluks. In the Chingleput and South Arcot districts the crop have been adversely affected due to delay in the setting in of the North-East monsoon and in-adequate supplies of water in irrigation sources. The crops are reported to be withering in four taluks in Chingleput district and in two taluks in the South Arcot District. More rains are urgently needed in those districts. In the Central districts the condition of the crop is reported to be satisfactory in Tiruchirapalli district. In the other district the crop is generally fair, but more rains are urgently needed. Supplies of water in irrigation sources are reported to bo in-adequate in the North Arcot and Salem districts and in the Pudukottai division. The condition of the crop in the Southern districts is reported to be below the normal due generally to delayed rains. In the Ramnad and Tirunelveli districts supplies of water in irrigation acources have not been adequate and the prospects of the crop are not encouraging. The progress of the crop in the districts of Malabar, South Kanarà and the Nilgiris is reported to be satisfactory and yields are expected to be normal or nearly normal. The paddy crop was also attacked by insect pests in certain parts of the Vishakhapatnam, Chingleput, Salem, Coimbatore and Nilgiris districts, but adequate remedial measures are reported to have been taken to check their spread. The average wholesale price of paddy, 2nd sort, per imperial maund of 82 2/7 lbs. (equivalent to 3,200 tolas) as reported from important market centers, on 12th November, 1949, was Rs. 7—15—0 in Nellore, Rs. 8—1—0 in Eluru, Rs. 8—2—0 in Nagapatnam, Rs. 8—6—0 in Tiruchirapalli, Rs. 8—8—0 in Kumbakonam and Tirunelveli, Rs. 8—10—0 in Vijayawada, Rs. 8—11—0 in Cuddalore and Rs. 8—15—0 in Masulipatam. (Economic Adviser, Government of Madras.)

Cotton Raw, in the Madras Presidency: (All figures in bales of 392 lb.) The receipt of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 to 2—12—1949 amounted to 3,92,717 bales of 392 lb. lint. The receipts in the corresponding period of the previous year were 3,46,686 bales. 5,26,402 bales mainly of pressed cotton were received at spinning mills and 9,184 bales were exported by sea while 1,01,092 bales were imported by sea mainly from Karachi and Bombay. (Director of Agriculture.)

Weather Review — For November 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	0·0	—3·9	37·7
	Calinga-patam	0·2	—3·2	33·6
	Vizagapatam	0·0	—4·7	38 7
	Anakapalle*	1·8	—1·2	49·1
	Samalkot*	0·0	—5·2	45·0
	Kakinada	12·0	+6·4	58·1
	Maruteru*	0·6	—4·1	48·9
	Masulipatam	23·9	+18·1	64·8
	Guntur*	0·7	—1·7	38·2
	Agrl. College, Bapatla*	3·3	—1·4	51·7
	Veeravanam* (College Farm)	2·7	(x)	51·3
Ceded Dists.	Kurnool	0·6	—0·6	41·9
	Nandyal*	2·3	+0·9	39·4
	Hagari*	0·1	—1·5	18·6
	Siruguppa*	1·1	—0·1§	31·4
	Bellary	0·6	—1·4	19·1
	Rentichintala	2·1	+0·2	30·7
	Cuddapah	3·1	—0·4	34·2
	Anantha-rajpet*	8·2	—2·1	48·3
Carnatic.	Nellore	4·4	—7·3	39·7
	Buchireddi-palem*	4·7	—10·2	34·3
	Madras	6·9	—7·1	38·2
	Tirurkuppam*	10·1	—2·6$	54·2
	Palur*	3·0	—13·7	31·8
	Tindivanam*	2·1	—7·6	25·0
	Cuddalore	4·3	—11·2	29·3
Central.	Vellore	2·3	—5·4	41·3
	Gudiyatham*	1·4	—4·6	40·1
	Salem	0·7	—3·1	32·8
	Coimbatore (A. C. R. I.)*	1·6	—4·0	16·5
	Coimbatore (C. B. S.)*	1·7	—4·5	16·8
	Coimbatore	0·8	—3·2	18·4
	Tiruchirapalli	2·5	—4·5	38·1

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	6·1	—11·4	28·8
	Aduturai*	7·6	—5·0	33·1
	Pattukottai*	3·9	—6·0	26·0
	Mathurai	3·7	—2·0	38.5
	Pamban	15·5	+3·8	31·4
	Koilpatti*	5·3	—2·3	24·5
	Palamcottah	5·4	—2·0	20·5
	Amba-samudram*	8·1	—3·8	20·9
West Coast.	Trivandrum	3·3	—3·2	56·8
	Fort Cochin	4·2	—2·5	139·0
	Kozhikode	1·5	—5·9	138·5
	Pattambi*	2·0	—3·7	98·7
	Taliparamba*	0·3	—5·9	164·5
	Nileshwar*	0·0	—6·6	169·4
	Pilicode*	0.2	—5·9$	160·2
	Mangalore	0·1	—3·8	159·7
	Kankanady*	0·2	—4·0	161·8
Mysore & Coorg.	Chitaldrug	0·6	—1·8	17·3
	Bangalore	0·1	—2·6	42·1
	Mysore	0·0	—2·7	28·4
	Mercara	0·2	—2·8	120·9
Hills.	Kodaikanal	7·7	—2·5	50·1
	Coonoor*	13·8	—1·0	48·7
	Ootacamund*	1·4	—7·3	41·5
	Nanjanad*	1·4	—5·6	48·8

Note:—
(1) * Meteorological Stations of the Madras Agricultural Department.
(2) Average of ten years data is taken as the normal.
(3) x Readings are being recorded only from February 1948.
(4) § Taluk office rainfall is 1·4" and normal is 1·7"
(5) $ Average of six years data for Tirurkuppam and seven years data for Pilicode is given as normal.

Errata:— The Rainfall data given for Pattukkottai in the October, 1949 issue may kindly be deleted.

Weather review for November 1949

The month commenced with a shallow trough of low pressure in the East Arabian sea off Malabar Konkan Coast. On 3—11—1949 conditions became favourable for the setting in of the North-East Monsoon along the Coramandel Coast. Two days later unsettled conditions were noted in the Andaman sea which persisted for about four days, particularly in the North Andaman sea. On 10—11—1949 the trough of low pressure became marked in the Bay of Bengal and continued to be so in the different portions of the Bay for about three days. Afterwards conditions in the extreme South-West Arabian sea also were markedly unsettled. The anti-cyclone over the Western Pakistan and South-West India became equally marked rather simultaneously.

The North-East Monsoon was found to be setting in along the Coramandel Coast on 16—11—1949. On the same day, night temperatures rose appreciably in the Madras Presidency outside Malabar and in East Hyderabad. For about two days the activity of the North-East Monsoon was felt in Madras Presidency, where local thunder rain occurred. In the last week of the month the North-East Monsoon was found to be strong in the Andaman Sea and the Bay of Bengal. Weather was on the whole dry throughout the month barring the days on which monsoonic showers were received. On 10—11—1949, Ootacamund recorded a minimum temperature of 30°F., which happened to be 19° below the corresponding normal. The North-East Monsoon showers happend to be far below the respective November normals for the various districts in the Madras Presidency. Particulars of the note-worthy falls in the month are given below :—

Date	Place	Rainfall in inches.
8—11—1949	Pachiparai near Nagercoil	5·0
17—11—1949	Madras (Meenambakkam)	5·0
17—11—1949	Madras (Nungambakkam)	4·0
17—11—1949	Nellore	4·1
17—11—1949	Ongole	4·1
17—11—1949	Cuddapah	3·0
21—11—1949	Pamban	3·8
21—11—1949	Alleppey	2·6
21—11—1949	Negapattam	2·2

Agricultural Meteorology Section, Coimbatore, Dated 12—12—1949.

C. B. M.

Departmental Notifications—Posting and Transfers.

GAZETTED SERVICE

Name of Officers	From	To
Sri Nataraj, T.	Junior Lecturer in Agriculture, Bapatla,	Gazetted Assistant to Director of Agriculture. Madras.
,, Ramaswami, K.	Teaching Assistant in Agriculture, Coimbatore,	Assistant Marketing Officer, Madras.

SUBORDINATE SERVICE

Arunachalam, S. -- Assistant in Paddy A. R. S., Aduturai, Paddy Assistant Seed Development Scheme, Mayavaram; Bala Raj, C. J. — A. D., Kumbakonam. F. M., A. R. S., Aduthurai; Bharathan, P. — P. P. A. (Mycology) Tanjore, P. P. A (Entomology) Salem; Bhukta, N. K. — A. D. (Narannapata, A. D. Ichapuram); Bapayya, D. — F. M. A. R. S. Lam Guntur, A. D. Repalle; Balasubramaniam, R. — A. D. Melur, Special A. D. Koilpatti; Duraiswami Iyer, G. — Retired F. M. Pudukottai State, F. M. Town Farm and A. D. Eastern Division, Pudukottai: Habibulla, K. S. — On leave, A. A. D. Pathapatnam; Krishnaswami, P. — On leave, Asst. in Millets, Coimbatore; Kuppamuthu, K. — Special A. D. Cotton Scheme, Srivilliputtur. Teaching Asst. in Agriculture, Coimbatore; Kolukutti Menon, M. — Asst. in Paddy A. R. S., Pattambi, Pepper Asst. Malabar; Krishnamurthi, P. S. — A. D. Wallajah, A. A. D. Kallakuruchi; Krishnamurthi, R. - A. D. Papanasam, P. A. to D. A. O. Tanjore; Lakshmanan, V. — A. D. Cotton Scheme, Coimbatore, A. A. D. Sivaganga; Muthaiah, V. — Asst. in Chemistry, Coimbatore, A. A. D. Mathurai; Mutharasan, G. — Asst. in Cotton, A. R. S. Palur. A. D., Papanasam; Narasimhachari, R. — On leave, P. P. A. (Mycology), Tanjore: Narayana Rao, D. — Teaching Asst. in Chemistry, Bapatla, Chemical Analyst. Bapatla; Narasimhalu, T. R. — P. P. A. (Entomology) Salem, A. D. Palladam. Natarajan, C. P. — Asst. in Chemistry, Coimbatore, Chemical Analyst, Coimbatore. Narasimha Reddy, R. — Soil Conservation Asst. Contour Bunding Scheme, Bellary. A. D., Cuddapah; Prabakara Rao, C. — A. D. Cuddapah, Contour Bunding Scheme. Bellary; Periaswami, S. — Assistant in Entomology Coimbatore, Assistant in Entomology, Shenbaganur; Ramadoss, A. — Millet Asst. Seed Development Scheme Nilakottai, A. D. Mathurai; Ranganathachar, N. — F. M. A. R. S. Aduthurai, A. D. Kumbakonam; Ratnakar Bhatkal, — F. M. — Livestock Research Station, Hosur. A. A. D. Udipi; Rama Mohana Rao, R. M. V. — A. D. Rapalle, F. M. A. R. S. Lam Guntur; Rajagopalan, K. — Asst. in Paddy, Coimbatore, Paddy Asst. Seed Development Scheme, Trichy; Rajogopalan, D. S. — Asst. in Paddy, Coimbatore, A. A. D. Devakottai; Radhakrishna Rao, K. — Asst. in Entomology, Shenbaganur, A. A. D. Kasargod; Raghavendrachar, C. — Asst. Agricultural Chemist, Coimbatore, Asst. in Chemistry, Coimbatore; Raman, K. R. — Fruit Asst. Wynad, A. D. Uthamapalayam; Ramaswami, N. — Special A. D. Cotton Scheme, Tirupur, F. M. Livestock Research Station, Hosur; Sethu Madhavan, R. — Asst. in Millets, Coimbatore, A. D. Melur; Satyanarayana, S. B. — A. D. Ichapuram, A. D. Narasannapatam. Sankaranarayana Iyer, C. V. — On leave, Asst. in Paddy, Coimbatore; Subramaniam, J. — Asst. in Fruits, Kodur, A. D. Kandukur; Syed Ahamadulla, - On leave, Millet Asst. Seed Development, Narasaraopet; Subramania Chetty, M. - F. M. A. R. S. Koilpatti, Special A. D. Cotton Scheme, Koilpatti; Srinivasan, K. F. M. Central Farm Coimbatore, A. D. Gingee; Srinivasan, S. T. — Asst. in Paddy A. R. S. Aduthurai, Paddy Asst. Seed Development Scheme, Sattur; Srinivasa Rao, B. — Pulses Asst. Coimbatore, A. D. Udipi; Sadasiva Shetty, Y. — Cotton

Asst. Coimbatore, A. A. D. Kasargod; Subba Rao, P. — A. D. Cheerupalle, A. D. Vuyyuru; Subramania Iyer, G. K. — On leave, A. D. Wallajah; Sambandam, R. — A. D. Palladam, F. M. A. R. S. Koilpatti; Suryanarayan, S. — F. M., A. R. S. Koilpatty, A. D. Palladam; Shanmugham, S. — F. M. Town Farm and A. D. Eastern Division Pudukottai, Special A. D. Sugarcane Scheme, Hospet; Subramaniam, J. — Fruit Asst. A. A. D. Chandragiri; Varaprasada Rao, T. — A. D. Vuyyur, A. D. Cheeprupalle.

The following postings of Assistant Inspectors of Fertilisers are ordered :

Names		Head-quarters.
Sri Ramalingam, G.	A. D. Kandukur,	Guntur.
.. Rajagopal, V. V.	On leave,	Coimbatore.
.. Ramaratnam, W. S.	A. D. Cuddalore.	Madras.
.. Seetharaman, P. M.	A. D. Uthamapalayam,	Mathurai.
.. Seethapathi Rao, S.	A. D. Pithapuram,	Cuddapah.

The following subordinates are appointed as upper-subordinates and posted to the vacancies shown against each :—

Janab Abdul Sattar — A. A. D. Palladam; Ayyappan, T. — F. M. A. R. S. Nileshwar; Adiyapatham, A. — Asst. in Cotton, A. R. S. Palur; Adiraja Kanniah, D. — A. A. D. Musiri; Ananthanarayanan, S. S. — Asst. in Cotton Winter Scheme, Coimbatore; Achutha Menon, N. K. — Asst. in Fruits, Mettupalayam; Appalanarasaiah, P. — F. M. Araku Valley; Bhimasastry, A. — Asst. in Paddy A. R. S. Maruteru; Syed Ruknuddin — Pepper Asst. Malabar; Chidambaram Pillai, K. — A. A. D. Dindigul; Janardhana Rao, T. V. — F. M. A. R. S. Siruguppa; Krishnan, C. H. — Asst. in Cotton Winter Scheme, Coimbatore; Krishnamaraj, N.— Asst. in Cotton Tinnies Scheme, Coimbatore; Kannaiah Naidu, A. K. — Asst. in Millet Seed Development Scheme, Attur; Krishnaswami Naidu, R. — F. M. Central Farm, Coimbatore; Krishnaswami, A. V. — Asst. in Oilseeds, Tindivanam; Kuppamuthu, C. K. — A. A. D. Vellore; Manuel, J. — Asst. in Paddy, Coimbatore; Marudachalm, K. P. — Asst. in Mycology, Coimbatore; Muhammad — Asst. in Paddy A. R. S. Pattambi; Meenakshisundaram, K. — Asst. in Pulses, Coimbatore; Narayana Rao, K. — Asst. in Mycology, Coimbatore; Narayanaswami Iyer, C. S. — Asst. in Paddy A. R. S. Aduthurai; Narasimham, K. V. — F. M. A. R. S. Hagari; Ponnuswami Pillai, D. — Pepper Asst. Malabar; Palaniappan, K. K. — Asst. in Cotton, Coimbatore; Pitchamuthu, C. M. — Pepper Asst. Malabar; Ponnan, P. — Pepper Asst. Malabar; Prasada Rao, K. — Millet Asst. A. R. S. Nandyal; Ramakrishna Rao, K. Bh. V. — A. D. Hadagalli (Bellary Dist.); Ramachandra Rao, K.— F. M. Bhagavathi Farm, Siruguppa; Rama Rao, C. V. — A. A. D. Kadiri; Raghavachari, R. — Asst. in Paddy A. R. S. Aduthurai; Ramachandran, G. — A. A. D. Mannargudi; Raghavachar, S. — Assistant in Oilseeds, Tindivanam; Raju, D. E. — F. M. A. R. S. Hagari; Samuel Christian, D. — Special A. D. Tirupur; Sitaramaiah, K. — A. A. D. Kurnool; Satyanarayana, B. — A. D. Hadagalli; Sreeramamurthi, Y. — A. A. D. Chandragiri; Srinivasa Iyengar, V. — Special A. D. Coimbatore Cotton Scheme, Srivilliputhur; Subba Naidu, T. — Asst. in Cotton A. R. S. Koilpatti; Sivaramakrishnaiah, M. — Soil Conservation Asst. Contour Bunding Scheme, Bellary; Theetharappa Mudaliar, R. N. — A. A. D. Sattur; Venkataraman, C. R. — A. A. D. Kumbakonam; Venkataraman, T. V. — Pepper Asst. Malabar; Venkataraman, K. — Asst. in Chemistry, Coimbatore; Valisi Naidu, K. — Millet Asst. Seed Development Scheme, Anakapalle; Venkataswami, V. — Soil Conservation Asst. Contour Bunding Scheme, Bellary; Veeraraghava Rao, K. — A. D. Rapur.

ANDHRA UNIVERSITY

Successful Candidates in B. Sc., Degree Examination in Agriculture — October, 1949.

First Examination :— *Passed in Agricultural :* 11, 12, 16, 20, and 22 ; *Passed in Botany :* 13 and 22 ; *Passed in General and Soil Chemistry :* 4, 9, 19 and 29 ; *Passed in Zoology :* 6, 17 and 22 ; *Passed in Agricultural Engineering (Civil) :* 2, 3, 4, 5, 7, 8, 14, 18, 21, 23, 24, 25, 26, 27, 28 and 30.

Second Examination :— *Passed in Agriculture Plant Husbandry I :* 33 and 53; *Passed in Agricultural Botany (Crop Botany and Plant Breeding and Genetics) :* 33, 37, 38, 41, 42, 43 and 52 ; *Passed in Agricultueal Chemistry (Orginic Chemistry and Plant Chemistry) :* 32, 33, 34, 35, 36, 39, 40. 41, 42, 44, 46, 47, 48, 49 and 50 ; *Passed in Agriculture Entomology :* 33 only ; *Passed in Agricultural Engineering (Mechanical) :* 33, 40, 41, 42, 43, 45, 51 and 53.

Final Examination :— Socond Class : 55, 56, 57, 61, 62, 63, 64, 66, 67, 68 and 69 ; *Passed in Agriculture - Horticulture :* 58 and 59 ; *Passed in Agriculture - Animal Husbandry and Dairying :* 59 only ; *Passed in Botany - (Plant Pathology) :* 54, 58 and 59 ; *Passed in Agricultural Chemistry :* 54 only ; *Passed in Animal Hygiene :* 59 and 60,

PRINCIPAL,
Agricultural College, Bapatla.

Agricultural College and Research Institute, Coimbatore

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1. BONNIER (Gert) and LARSON (Robert): Ed. Proceedings of the VIII International Congress of Genetics Stockhohm. 1949.
2. BRWON (W. H.): Plant Kingdom — A text book of General Botany. 1935.
3. FLORKIN (M): Ed. Biochemical evolution. 1949.
4. FLOSDORF (E): Freeze drying — drying by sublimation. 1949.
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19. BRITAIN: Can breed it-Livestock of British Isles reviewed.
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22. LONDON: Chemical society: Annual report on the progess of Chemistry. 1948 — 1949.
23. INDIA (Delhi): Preparatory Asiatic Regional Conference of the International Labour Organisation — Report I problems of Social security. 1947.
24. ....Report II Labour policy in general including the enforcement of labour measures. 1947.
25. ....Report III programme of action for the enforcement of social standards embodied in conventions and recommendations not yet satisfied or accepted. 1947.
26. ....Report IV Economic background of Social policy including problems of industrialisation. 1947.
27. INDIA (Deccan Sugar Technologists Association: Proceedings of the fifth Annual convention. Pt. I. 1948.
28. ENGLAND: Imperial Institute of Entomology: Report of fifth Commonwealth Entomological conference. 22 — 30 July, 1948.

D. B. K.